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NAVY'S FLAPJACK MYSTERY PLANE
It Hovers Like a Helicopter! Will It
Fly Faster Than the Speed of Sound?
See Page 58

**THE MAN WHO MAKES MONSTERS
BUILD A SOAP-BOX DERBY WINNER SEE PAGE 112**

The Flying Flapjack

BY GILBERT PAUST



Photos by Rudy Arnold

It looks like an aviator's nightmare, but this Navy job is the fastest - and slowest - plane in the air.

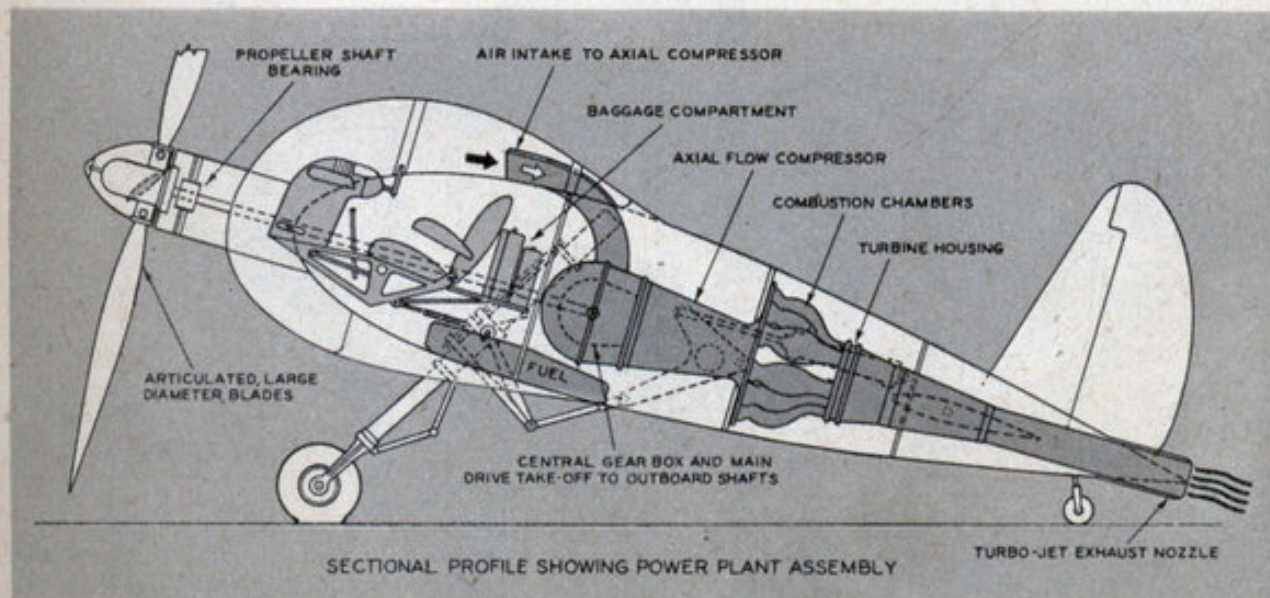
THE Navy has a flying Flapjack, and brother—it can fly!

It all began on a day in November, 1942, when the doors of the Vought hangar opened and test engineers trundled out a queer, saucer-shaped object on two long, stilted legs—and claimed it was an airplane. The V-173, they called it, and gave credit for its design to an aeronautical engineer who had been active in NACA research and had recently joined the staff of Chance Vought: Charles H. Zimmerman.

The test pilot, Boone Guyton, climbed the ladder that led to the small door under the nose, and entered the pilot's nacelle. The two huge, three-bladed propellers, protruding from the sides and looking more like helicopter rotors mounted vertically than conventional "props," started turning. With its nose pointing into the sky at a steep angle, the Flapjack flew.

Not much has been told about that first flight. The plane's first performance did not cause a great sensation among the

Tomorrow's Flapjack will be equipped with a gas turbine and jet assist, making higher speeds possible.





The V-173 is entered through a hatch below the pilot's cabin. Excellent visibility is provided through nose.

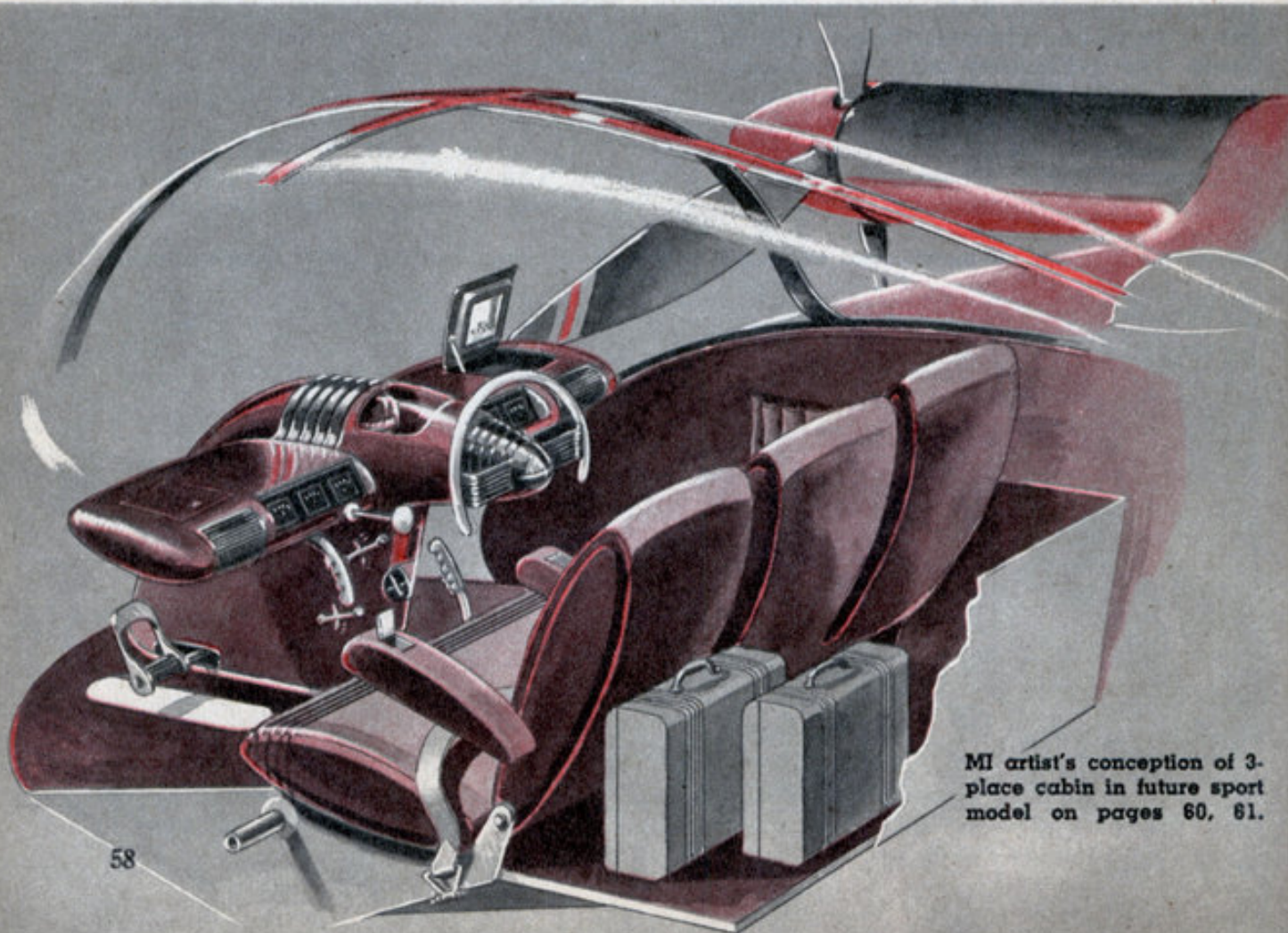


The XF5U-1 has retractable gear and is powered by two 1800-hp. engines. It is metal covered and uses four-bladed propellers, although its plan-form is the V-173.

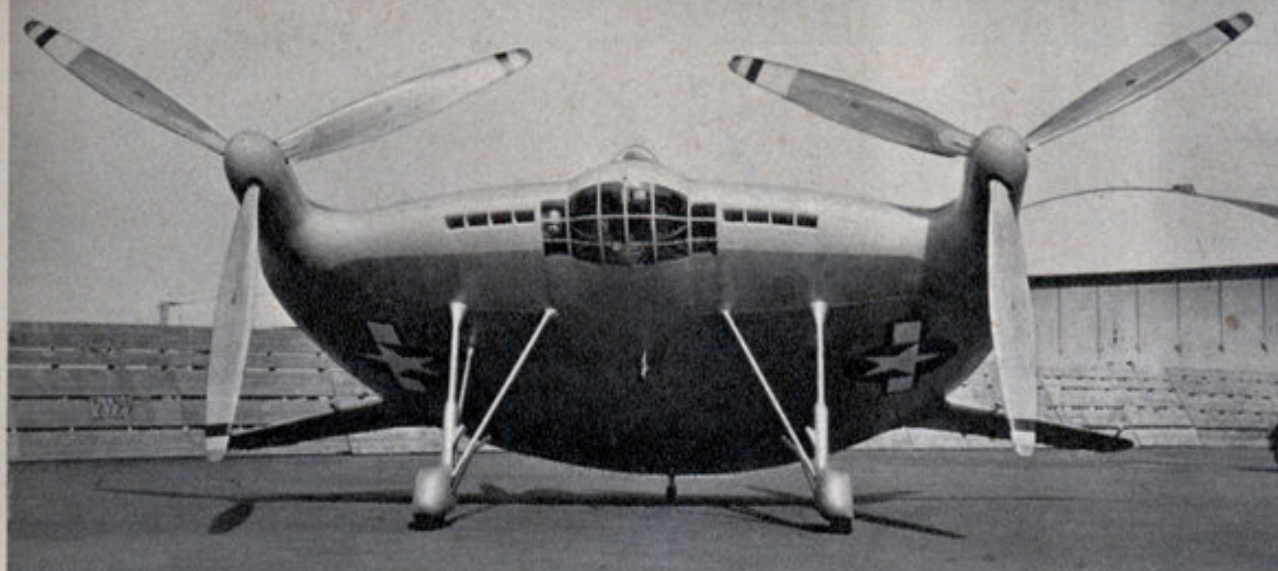
press at that time. The world was at war and there were many more important events happening in the skies to take the headlines. This new "crate" was just a bad dream, too radical a departure in aircraft design to be taken seriously. Even military censorship didn't know exactly how to handle it. Photographers shot some pictures; these were published and soon forgotten.

A couple of years later a new, slicked-up model was announced, bearing the Navy insignia and the designation XF5U-1. Nothing much was said about it. No mention of a test-flight was made. A couple of "hangar" pictures found their way into the newspapers and then the Flapjack faded from view, quickly smothered by warfront news.

The Flapjack wasn't scrapped; it is po-



MI artist's conception of 3-place cabin in future sport model on pages 60, 61.



High landing gear are necessary to hold propellers clear of ground. Airflow covers wing and tips.

tentially the world's most versatile airplane. All attempts to obtain information from its manufacturer and the Navy on its present status and performance have met with blunt refusals. The following facts have been gathered for you from reliable sources. Read them over and take your hat off to the slickest thing in the air!

The basic wing plan of the plane is a circle designed as an airfoil to obtain lift from the air, at the same time serving as fuselage to house the pilot and engines. The large propellers are tractors, driven by fuselage engines with which they are connected by a gear-and-shaft arrangement. They turn at approximately $\frac{1}{5}$ the speed of the engines. The propeller shafts project forward from the sides of the wing, positioning the propellers so that their airflow is continuous over the wing.

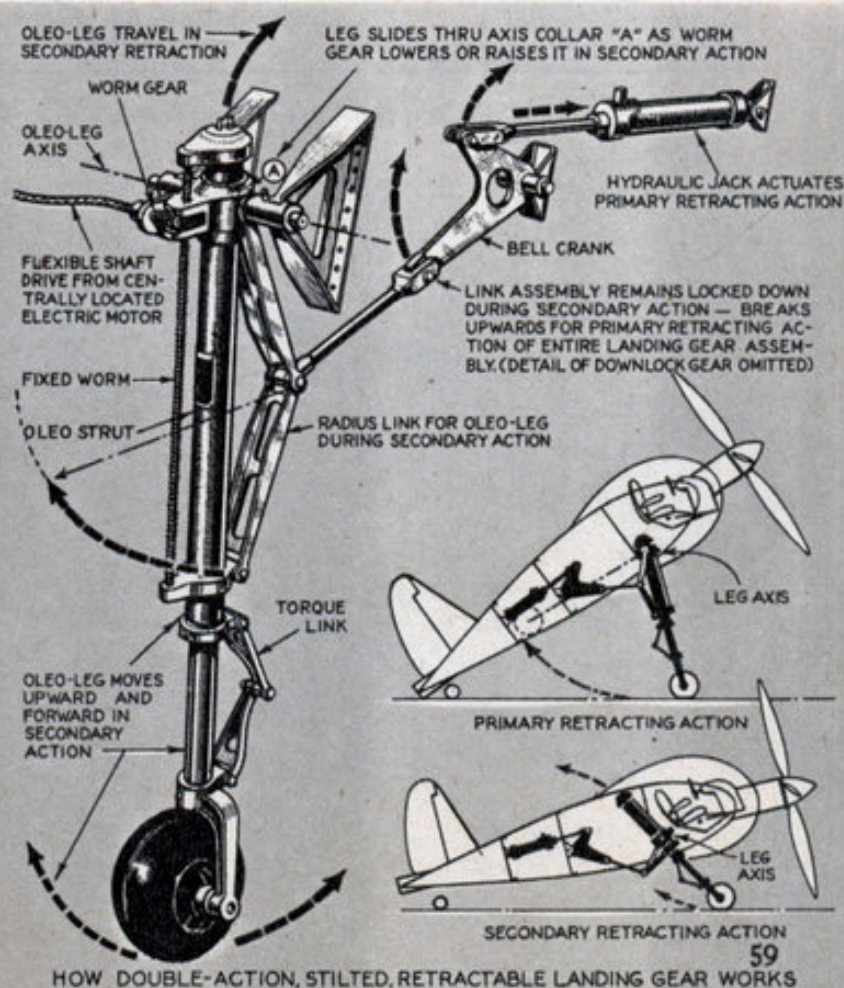
A conventional wing "stalls" (loses lift) when the airflow over its surface, caused by the travel of the wing through the air, is broken (burbles) at slow speed. In the Flapjack, however, since the airflow over the wing is not caused by its motion but by the propellers, the airflow remains unbroken and lift is maintained even at slow speed. Although the actual aspect ratio of the wing (span divided by width) is less than

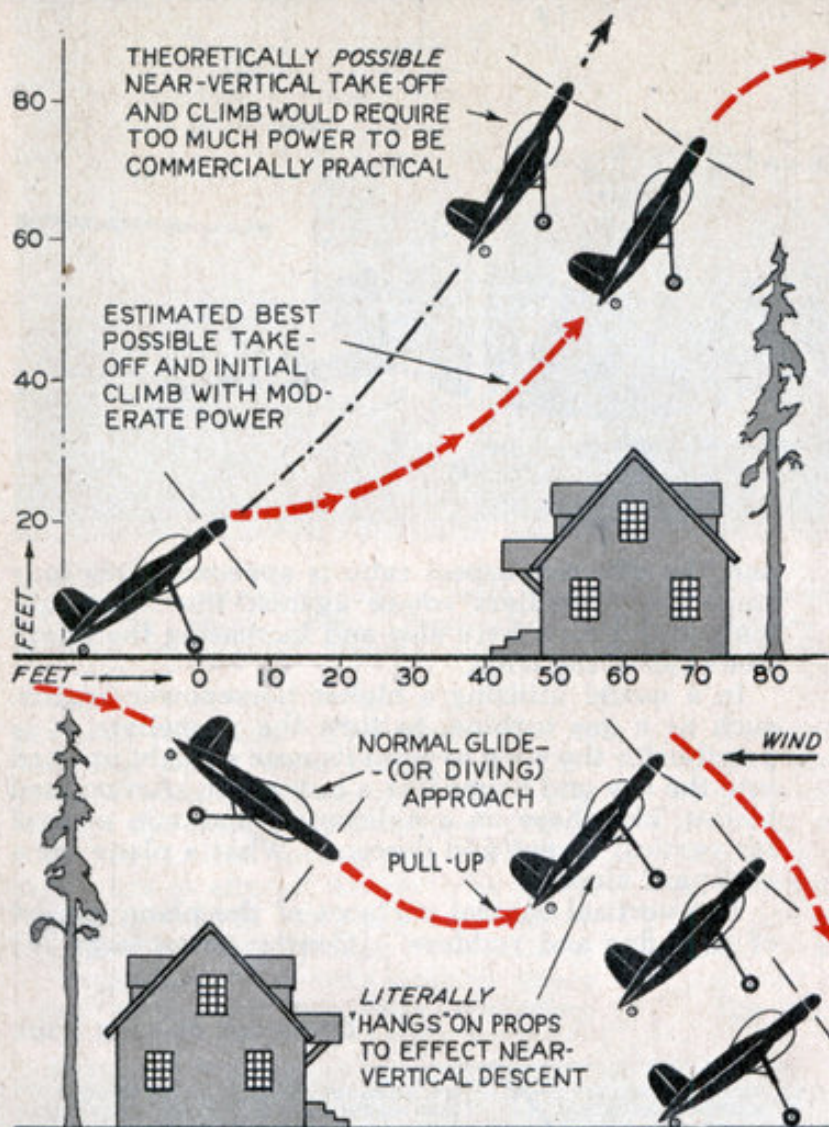
one, the effective aspect ratio is approximately four since the propellers rotate against the wing tips, maintaining flow here also and increasing the effective span of the wing.

In a model utilizing a higher horsepower engine, such as a gas turbine, to turn the propellers, it is possible for the wing to point its nose straight upward into the sky and hover like a helicopter. Articulated blades, like those on a helicopter, maintain control for vertical ascent and descent. What a plane for a backyard airport!

The vertical control surfaces of the plane consist of twin fins and rudders, [Continued on page 79]

Drawings on next page





TAKE-OFF AND LANDING POTENTIALS

UNIVERSAL JOINT

GEAR BOX

COMMUNITY HANGAR

SEAT UNIT
NORMAL

AILEVATOR
(DIFFERENTIAL ACTION PER-
MITS COMBINED FUNCTIONS—
AILERON AND ELEVATOR)

DOUGLAS
ROLFE



The slow-fast flight characteristics of the Flapjack make it an ideal design for a sportplane. With extending, retractable landing gear (as shown on previous page), this 3-place model, designed by an MI artist, could operate from small fields only slightly larger than an ordinary backyard. At right is the V-173 in flight.



Scientists Raid the Ocean Floor

Explorers now aim at the conquest of the sea floor, a great dim world of incredible riches.

A LOUD blare of confused noises breaks in upon the botanist's thoughts, distracting his attention from the bizarre plant he has been studying intently in the dimness of the sea bottom.

He sighs, and a thicker-than-usual flock of bubbles burbles up from the artificial "gills" which enable him to breathe his oxygen directly from the water.

Oh, for the calmness of the campus! he thinks. Back at the university science could be science and not just a bag of under-water tricks!

Then at once a voice sounds in his helmet. "Professor Jones, return to the station," it says. "Acknowledge."

"Jones is returning to the station," the botanist says promptly into the mike of his helmet radio.

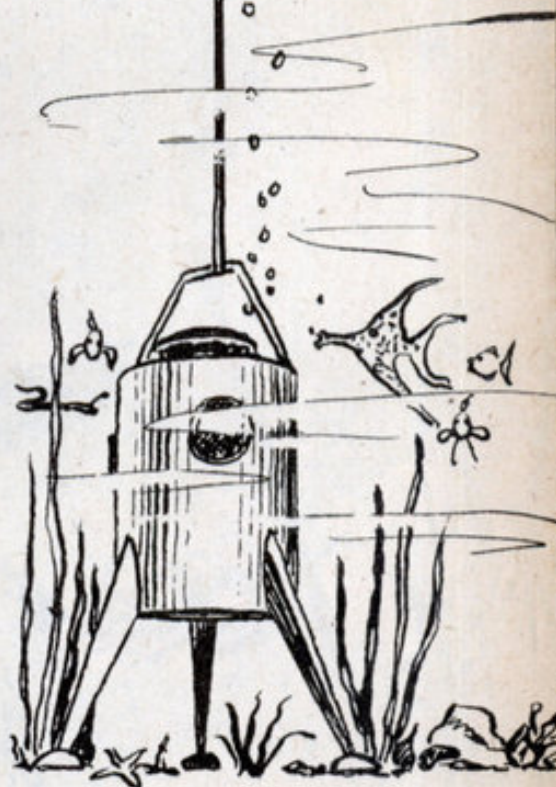
Several hundred feet away at the station—which is a movable under-water laboratory "house" then resting on the

ocean floor—his associates catch his acknowledgement; and it is caught, too, by the tender on the mother ship on the surface, 125 feet above.

Resisting every floral temptation which comes to focus in the rays of his headlight, the professor slowly makes his way straight for the lights of the great laminated steel structure in which the entire research party has spent the last ten days. He enters at once, not having to wait to accustom his body to the lesser pressure because his breathing mask furnishes him an oxygen-helium atmosphere instead of an oxygen-nitrogen.

Inside, the technician in charge is talking over the telephone to the upper world. "Move us 150 yards north-north-west," he says. A calm voice answers over the loudspeaker housed in the roof of the laboratory, and slowly the lab begins to move through the dim waters.

There's danger on the ocean floor! A large shark swims menacingly above this diver at Marine Studios, Florida.



The above is no vague dream but the picture of an experiment in undersea living and research soon to be carried out. It will be the culmination of centuries of progress in underwater research.

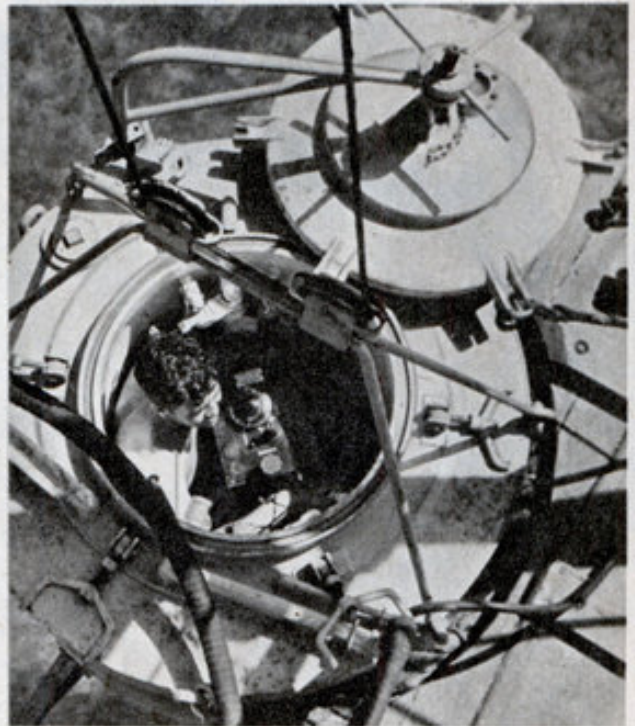
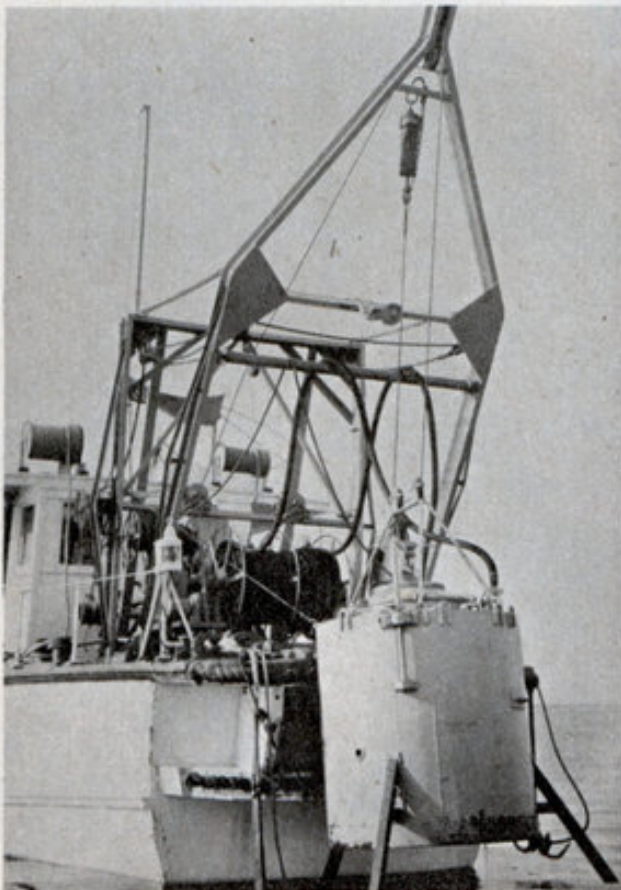
The United States government has for sometime been carrying out extensive hydrographic surveys to determine the contour of the undersea land. The charts resulting are now printed in booklets available to everyone, for industrial or private use—so you may build an undersea house somewhere off the Atlantic or Pacific coasts, or grow an undersea garden, or cultivate pearls, or sail under the surface, or dive just for pleasure.

Navy scientists and other research workers have perfected under-water sound systems which will enable us to locate survivors lost many thousands of miles at sea. Sound at a depth of 2,000 to 6,000 feet has such amazing propensities for travel that the water becomes a veritable speaking-tube. Tests conducted in the Bahamas during the war showing that survivors dropping a package of TNT timed to explode at 3,000-4,000 feet could produce a report audible in useful intensities 3,100 miles away. Three or more hydrophone stations, widely separated, could pick up the signal, obtain a "fix"

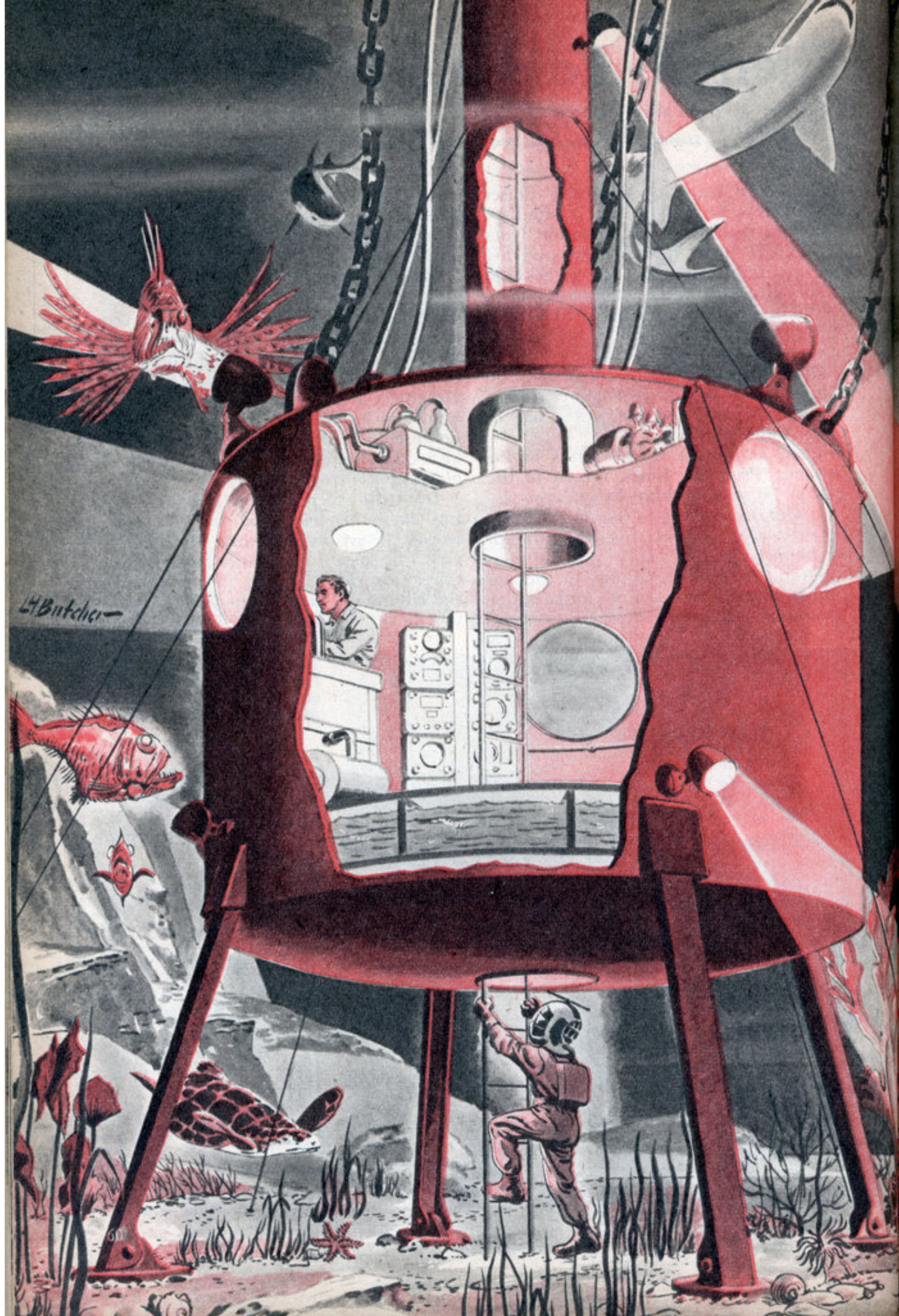
and send out rescue planes immediately.

But probably the most important work has been in diving, resulting in the development of the under-water laboratory. These houses, now in the experimental stage, will be able to hold as many as a dozen occupants along with laboratory and sleeping facilities; and the next few years will see them attack deeper and deeper levels of the sea, where groups of trained scientists will study vegetable and animal life, discover minerals and sea wealth, and conduct undersea experiments. In the shoal depths these houses will be equipped with double-lock doors, so that the scientists can come and go as they please; and there will be other facilities to prevent bends, in addition to helium breathing.

Teams of diver-botanists and explorers will move from the laboratory into the dimness of the accessible sea-floor world with their cameras and equipment. The geologist will study at first hand the ocean bottom, a modern explorer dressed like a man from another planet. Physicians will test the reactions of men in such conditions, and others will advance still further the research which will make possible complete domination of the undersea. [Continued on page 90]



A two-ton diving chamber used in the search for oil. The gravity meter in front of the operator helps indicate its possible presence by mapping the geophysical formations beneath the surface.



Through a small window the man at the controls sees the light from the upper world streaming down through the dark water like sunlight through the stained-glass windows of a cathedral.

A third man, on watch at another window, flashes on one of the big searchlights attached outside—scattering a crowd of curious fish that have been gazing through the window at him. Slowly the "house" comes to a stop.

"Better move us 20 yards north-northeast," says the technician in charge. "I can see the edge of the abyss." On the surface, orders are barked, the mother ship swings, and the great house inches slowly sideways, then downward, coming to rest with its pronged legs stuck in the rich mud of the deep. A scientist at the dials of the undersea laboratory reads off the pressure. A voice from above comes over the loudspeaker.

"You are resting at 154 feet," it says.

There is sudden activity inside. One of the scientists starts checking the diving equipment and apparatus stored along one side of the house. Others take down readings from the dials and make observations through the four windows. The man at the phone relays the readings to the surface where a trained crew of technicians and scientists start checking and calculating. . . .

Artificial gills! Helium breathing! Undersea laboratories! Electric lighting, telephones, radio and walkie-talkies on the ocean floor! Some of these inventions already are at hand. Others are just around the corner—not far around it. Scientists are overcoming the final obstacles to opening up a whole rich new world—the world that lies deep below the surface of the waters.





INTERMESHING
EGG-BEATER
TYPE ROTORS

FAIRED-IN
ROTOR HEAD

GEAR CONVERSION
BOX FOR ROTOR
SHAFT DRIVE

BAGGAGE OR MAIL COMPARTMENT
(33 CUBIC FEET CAPACITY)

A detailed illustration of the Kellett KH-2 helicopter, a 'pinwheel' model with three rotors. The helicopter is shown from a side-on perspective, with its rotors partially visible. The fuselage is silver with red and white stripes. The registration 'NC 4014' is visible on the side. Several passengers are shown: a man in a suit and hat stands near the open cabin door, a woman in a red dress and hat stands nearby, and another man in a suit and hat stands in the foreground. The background shows a cityscape with buildings and hills.

ALL-METAL TRANSPORT STYLED FUSELAGE

ROTOR BLADES 32'-6" LONG
(65'-0" DIAMETER), OVERALL
WIDTH (BOTH ROTORS), 69'-4"

DOUGLAS
ROLFE

550 H.P. ENGINE
(ONE EACH SIDE)

page. The "pinwheel" bus is taking form in Kellett Aircraft's plant in North Wales, Pennsylvania. It's a helicopter, of course, and it's called the KH-2. It will carry ten passengers, too, just as the sedans do. But there similarity ceases. Instead of crawling along through traffic, you'll go over the building tops at a speed of 118 miles per hour. You'll land on a city roof, possibly your own hotel, and slip down to the street in an elevator. That last 20 miles of post-arrival travel will become 15 minutes of fun instead of a boresome hour.

The KH-2, which Kellett says will be ready for use in about eight months, will carry a total useful load of 2,942 lbs., and will have a gross weight of about 11,600 lbs. Range will be 180 miles.—C. B. Colby.



Time-killing bus rides from airports to cities will soon be quick hops in ten-place 'copters.

FROM the window of the airliner, you look down upon the city of your destination. The plane turns with deceptive laziness—you're moving at a rate of almost 200 miles per hour—and approaches the field. Minutes later you step to the ground. Ah, the wonders of flying. The two cities are 200 miles apart. You've gone from one to the other in a little over an hour.

But have you? Let's see what happens next.

You climb into a "sedan" with ten other "air travelers" and start out for the city in which, according to the timetables, you have already arrived. You wait for the stop signs. You slow down to 20 behind that truck until the road clears. Traffic thickens in the suburbs. Maximum speed limit, 30. You wind through the freight yards. You angle through the factory district. With luck,

you twist through a green park. More stop signs. But at last you've really arrived, one hour after your official arrival.

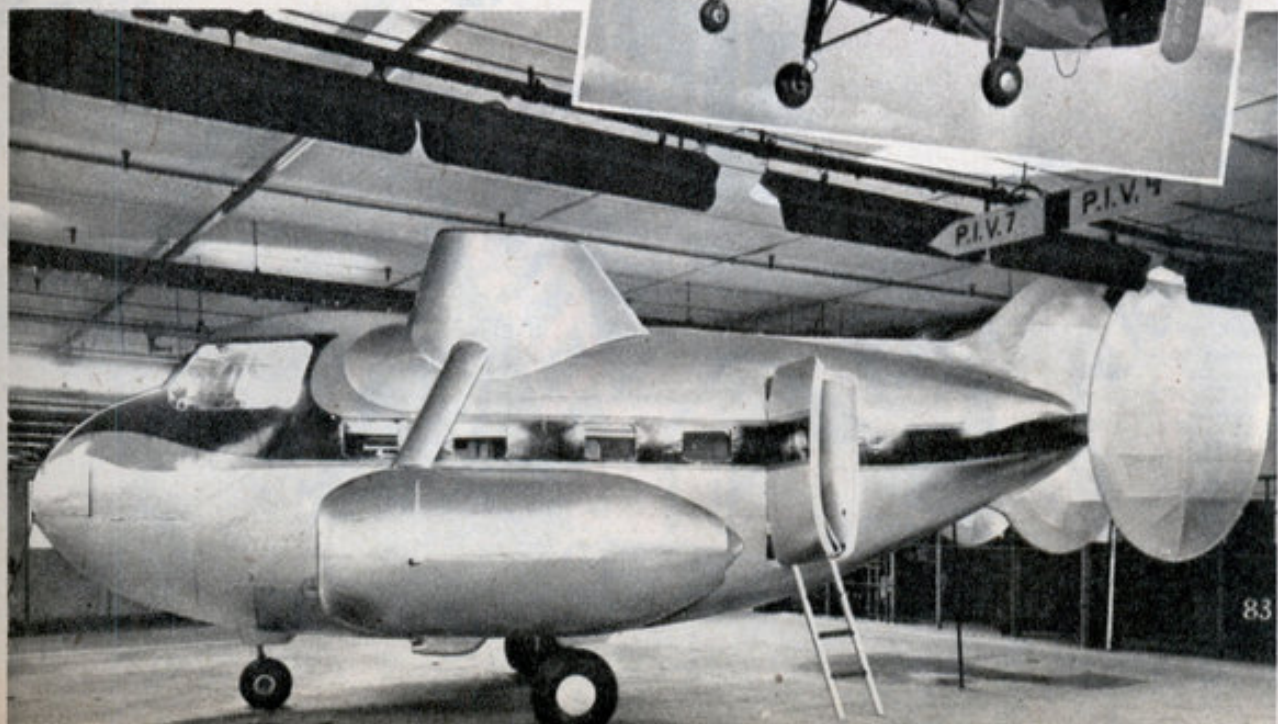
That last 20 miles cut down your average speed a bit, didn't it? Getting into town took as long as your 200 miles of air travel. If only that "sedan" (airline language for "bus") could grow wings.

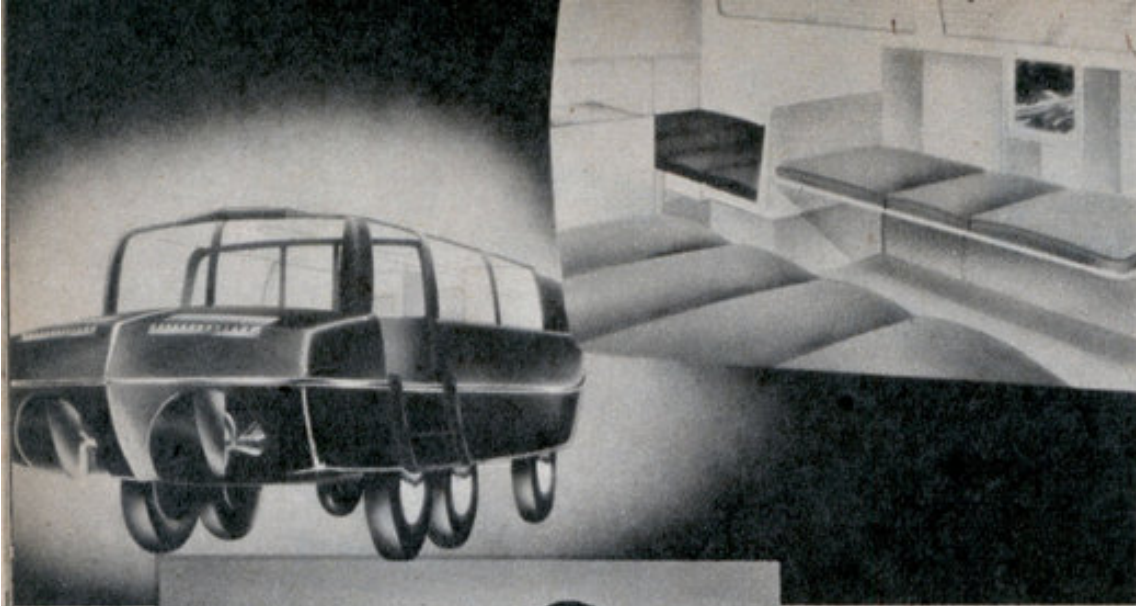
Well, its counterpart *is* growing wings. All of the above is the picture of air-travel today. You'll see a picture of tomorrow—an early one—as you turn this

The six-bladed, twin-engine XR-8 was the guinea pig for the new air-bus.



You won't worry about traffic or stop lights when the KH-2—in mock-up form below—heads into town at 118 miles per.





The props are housed in twin tunnels and the television receiver is installed over a couch-bunk in the main living salon. Blow, Mr. Zeidman examines a scale model of his luxurious amphibian.



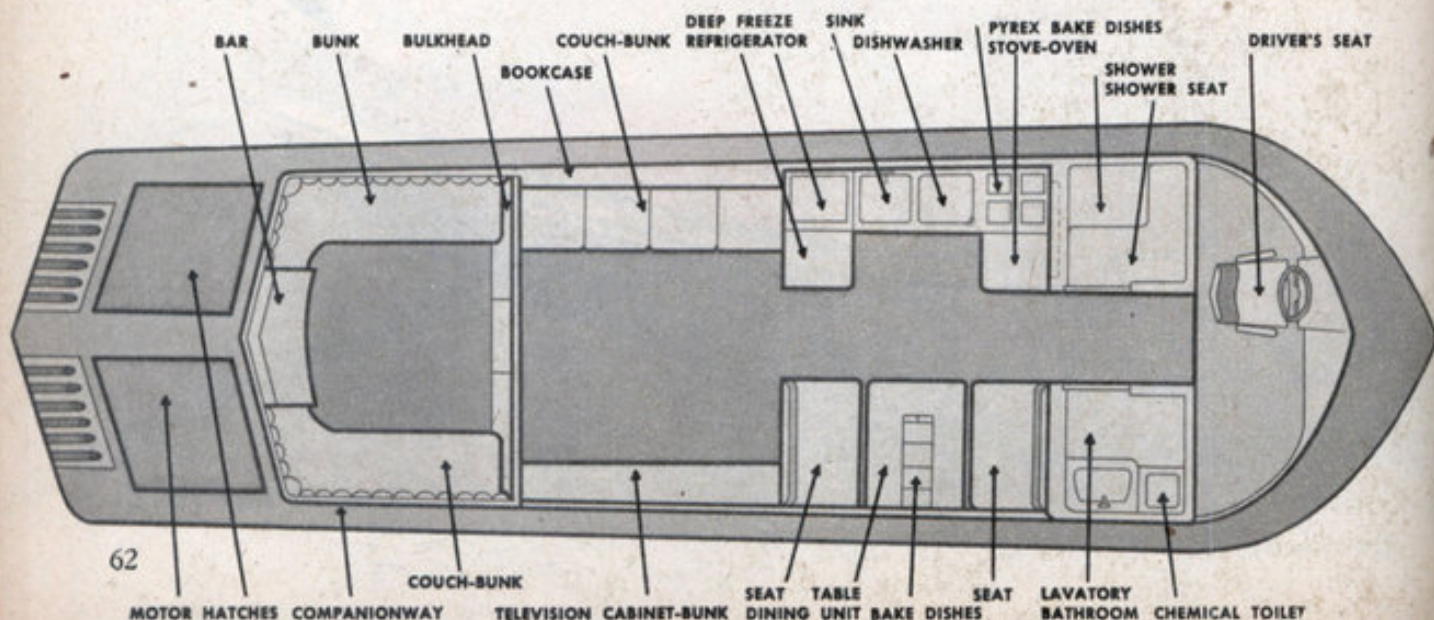
descendant of some of the Navy's experimental vehicles, not the Army's familiar DUCK. It promises a sustained highway speed of 55 mph and a respectable 10 to 12 knots afloat. Efficient land speed was the first consideration in specifying power; the excellent showing on water is due to im-

proved lines and to the twin screws in tunnels, driven by the twin motors in the stern. Twin rudders give maximum maneuverability.

The lines and the water speed will be subject to some variation in the transition from plan to production, depending on the choice of materials and the owner's requirements. The design is adaptable to hull construction of heavy or light metals, to the newer molded wood products, or to combinations. Original plans are for a 34-foot craft, sleeping six people. A second model, 28 feet long, sleeping four, will follow soon.

The experience both of yacht and trailer builders has been called on in fitting the necessities for comfortable living into limited space.

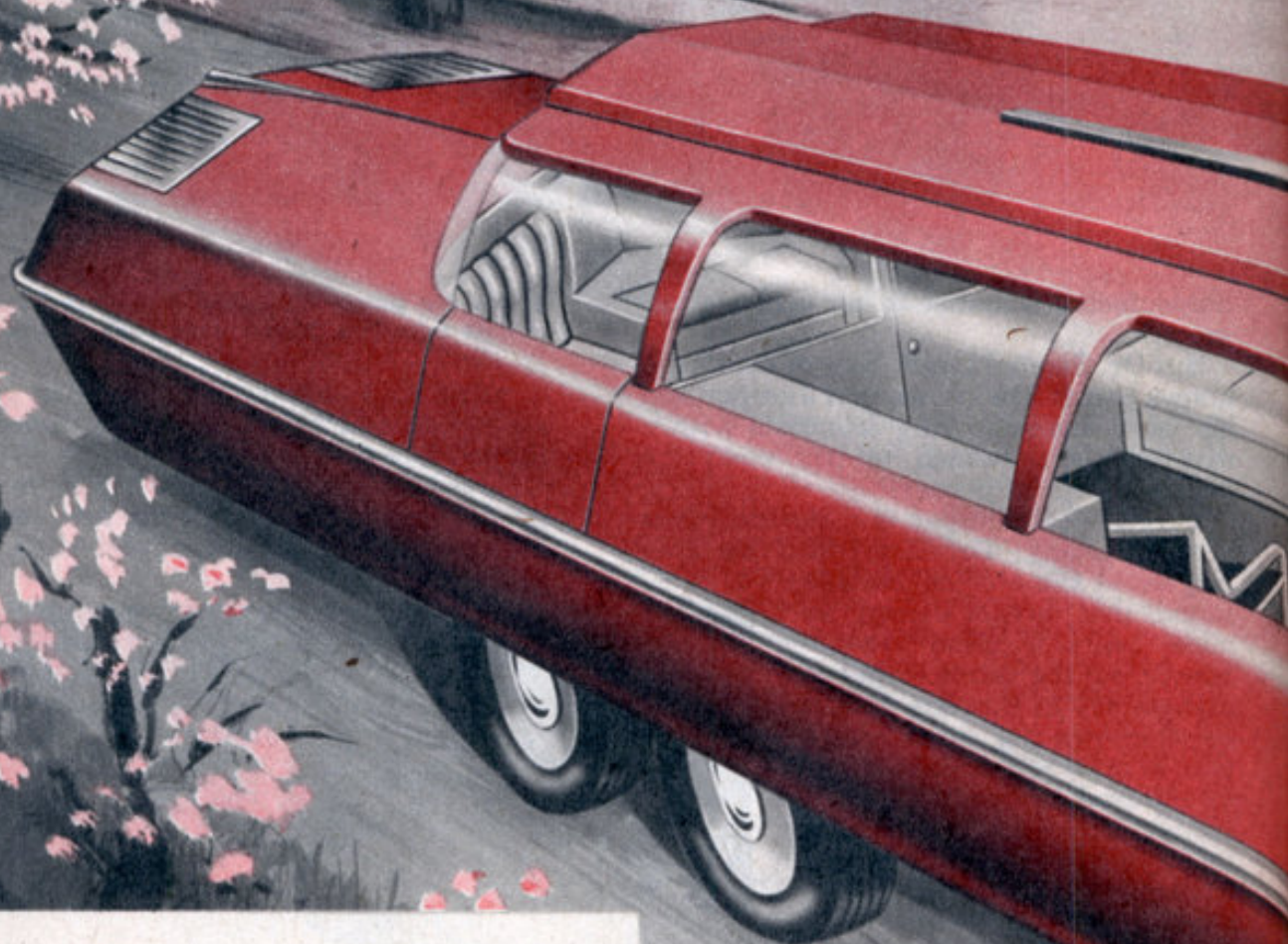
Entrances are at the stern on both port and starboard sides through special sections folding downward and outward over the "gunnel" to form wide-stepped boarding ladders. The after compartment is the observation and lounge section on the road. It has a built-in bar and radio and handy storage space for sports gear and marine equipment. It is converted into a fishing cockpit afloat by moving certain sections [Continued on page 173]



WATER-MOBILE

BY EVERETT H. CLARK

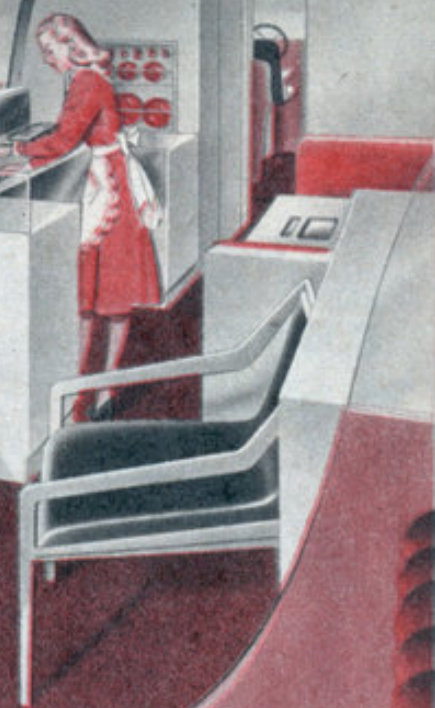
**When the water calls you go cruising ...
when the road beckons you go rolling ...
always snug inside your traveling home.**



THE millions of ex-GI's who watched wartime amphibious craft climb dripping up the beachheads will recognize the substance of dreams of their own in the "Vacationer," an amphibious luxury cruiser proposed by industrial designer Robert Zeidman for practical peacetime use.

The new civilian amphibian is a

Looking forward on port side
we see lounge in main salon,
galley, bath and shower com-
partments and driver's seat.



DOWN

Yes, he'll go down four miles
BUT - - - will he come back up?

GOES PICCARD!

BEEBE BATHYSPHERE
SUSPENDED BY CABLE
REACHED A DEPTH
OF 3,028 FEET

THE African sun slants its dawn rays across the Gulf of Guinea. From the deck of a ship a huge crane swings out over the water. Slowly it descends and with scarcely a ripple deposits the amazing Thing on the ocean's face.

Inside the Thing a little man with wide, metal-rimmed glasses orders crisply: "Cut the ropes," and the world's strangest submarine, its only contact severed, begins its descent into the world of endless night in the ocean's depths. Through the portholes the light of day fades quickly. The zoologist, the little man's only companion, peers outside, scribbles his observations. Time passes.

The free swimming submarine is now miles below the surface, in the heart of the black deep which two powerful arc lamps turn into a wonderland of marine fantasy. A dozen hours have elapsed. His studies complete, the professor presses a switch and. . .

But here this narrative must stop.

Up to this point we know what will happen when the little man, who is Professor Auguste Piccard, of stratos-

Beebe used a cable, Piccard won't. His stratosphere pal, Max Cosyns, right, will go too.



PICCARD SUBMARINE GOAL:
FOUR MILES DEEP

When Piccard, above, drops ballast, his sub—see model, right—will bob to surface—he hopes.

phere fame, makes his fateful experiment.

But will his invention, upon which he has worked for years, rise to the surface? The professor himself does not know. The answer will be flashed to the world from the west coast of Africa on a February morning when the professor attempts to descend four miles into the ocean, far deeper than the present record of 3,028 feet held by Professor William Beebe.

The steel sphere in which Piccard will make his perilous journey into the unknown weighs ten tons, is nearly seven feet in diameter and has walls three and one-half inches thick. Nevertheless, without ballast, it is lighter than sea water, and therein lies the professor's hopes.

Without the lighter-than-water twist,

the bathy vessel would plummet into the sea and be lost forever. For there will be no cable, such as was used by Beebe, to haul it back to the surface. A cable would permit Piccard's sphere to dangle no deeper than Beebe went . . . if he went further the weight of the cable would almost certainly cause it to snap.

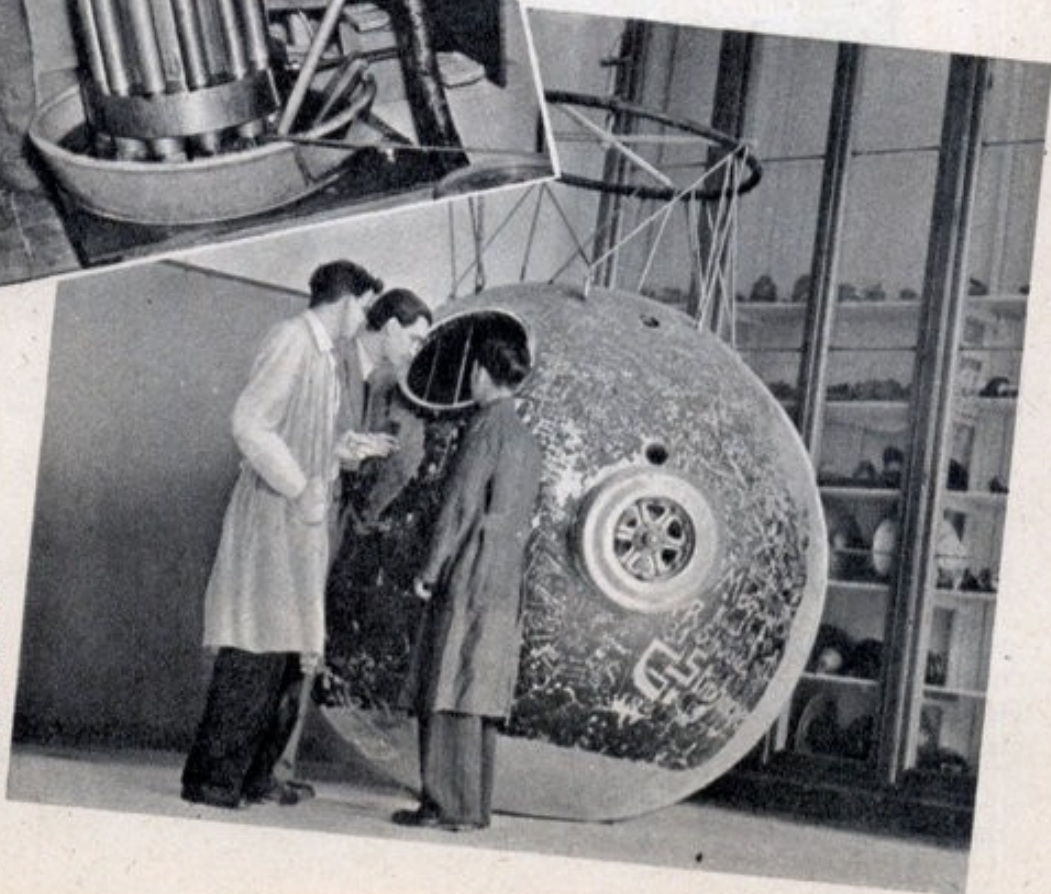
Piccard hopes to rise again through applying the balloon principle to his queer submarine. To the sphere Piccard has attached a boat-shaped float filled with 494 cubic feet of a light, buoyant oil. This takes the place of the hydrogen gas bag on a balloon. Below it, held tightly by electromagnets, are large chunks of iron ballast. If a speedy ascent is demanded, these large pieces of iron can be released, but the professor has arranged for a slow, controlled method of rising. In a large copper funnel he has placed hundreds of pounds of iron filings. When current to the electromagnet is cut, the filings flow out at the rate of 60 pounds a minute.

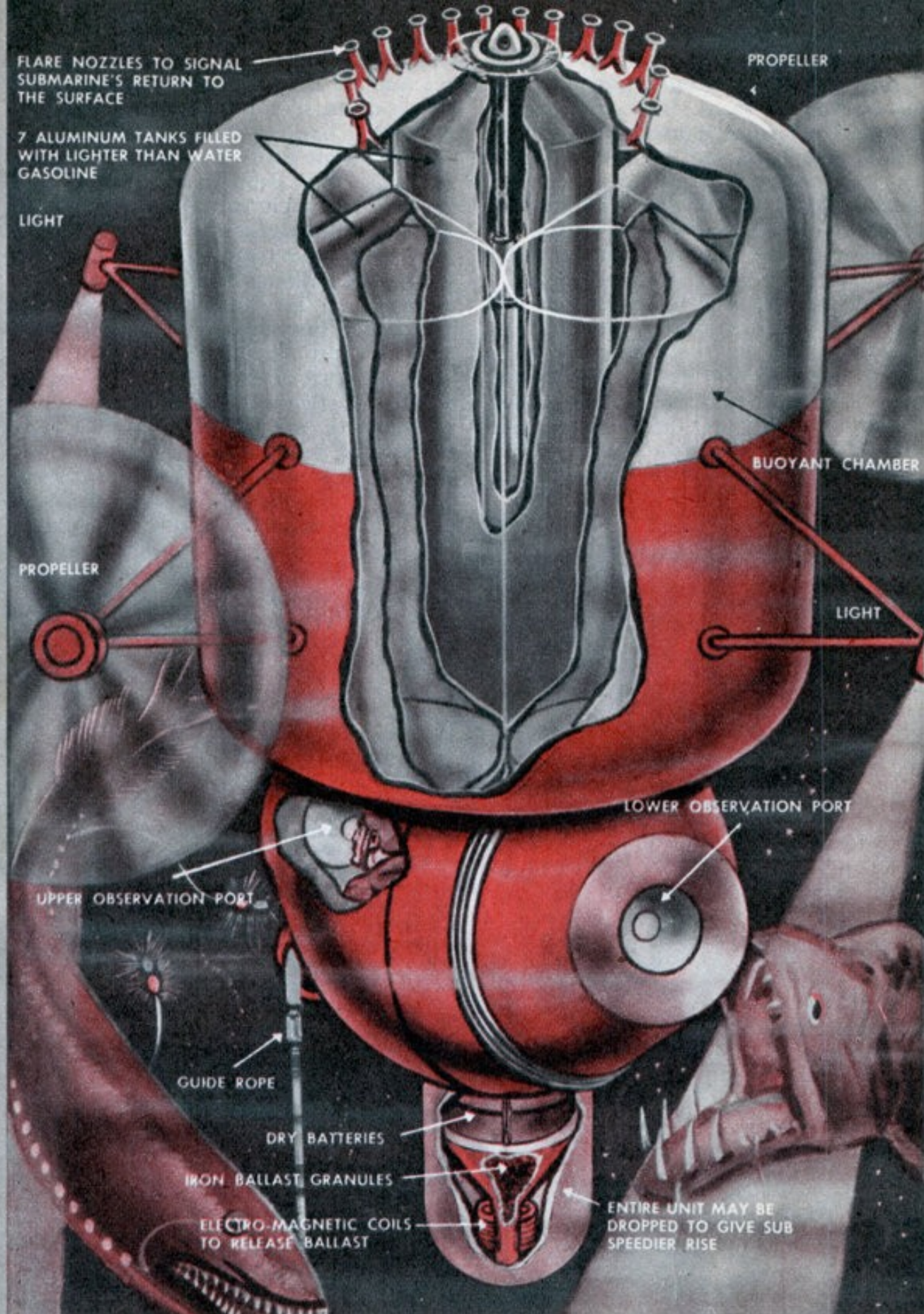
There are two plastic port-holes, six inches thick, on each

Left: In this tester, Piccard and Cosyns give their model 3,000 lbs. pressure. It hasn't broken—yet.



After Piccard went up five miles in his balloon—cabin, right—he promised his wife he'd never go stratospher-ing again. Stuck with that pledge, he'll go four miles underwater.





side of the cabin. One is for photographic equipment which will automatically snap ten pictures per second, and the other will be used by the two men for observations.

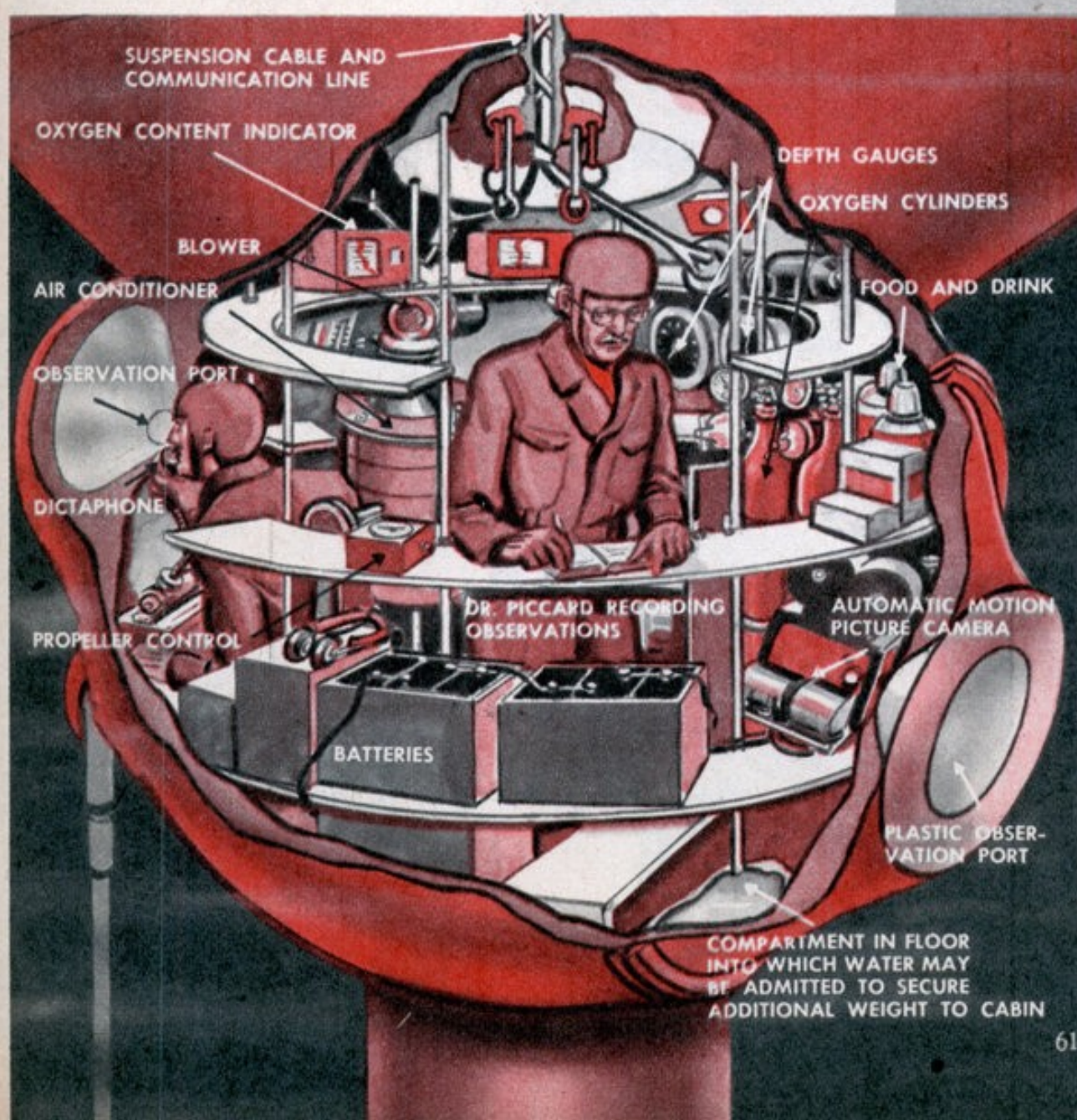
To pierce the gloom of the deep, Pic-

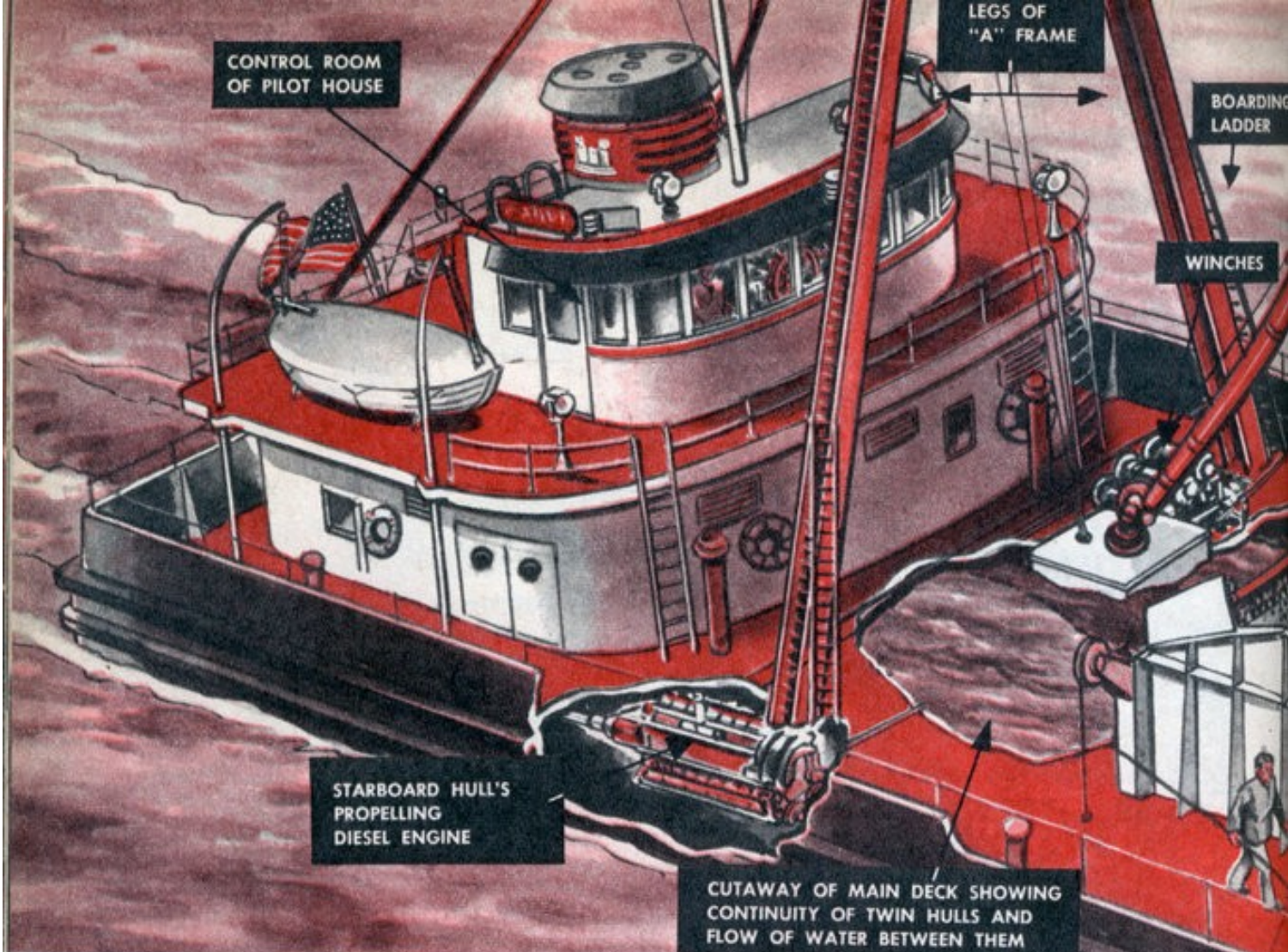
card has attached 3,300 candlepower arc lights in such a way as to produce streams of light which will cross the axis of the portholes perpendicularly. And he has provided two electrical motors which will

move the sphere forward or backward. The speed will be low, about five inches per second.

Professor Piccard hopes to enrich immeasurably science's presently limited knowledge of the ocean's depths. Virtually all that man knows has been gleaned from the admittedly unsatisfactory soundings and net castings from surface ships. Divers have not been able to go deep enough or stay long enough. Beebe alone has ventured down but, thinks Piccard, not far enough.

And so the eminent professor, who was the first to soar ten miles into the stratosphere, is poised to set another record, destination downward—round trip preferred. February will tell.





CONTROL ROOM
OF PILOT HOUSE

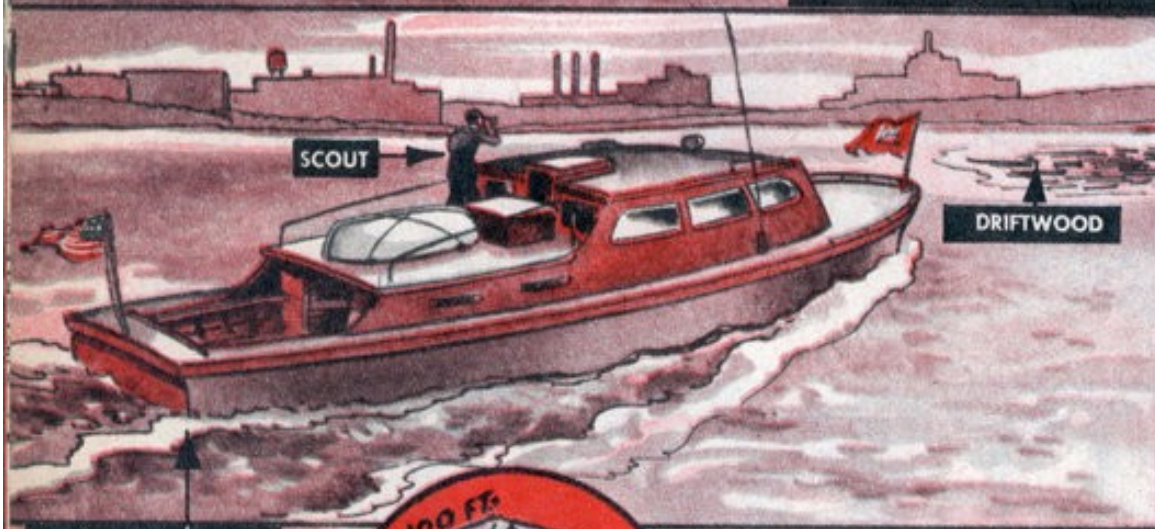
LEGS OF
"A" FRAME

BOARDING
LADDER

WINCHES

STARBOARD HULL'S
PROPELLING
DIESEL ENGINE

CUTAWAY OF MAIN DECK SHOWING
CONTINUITY OF TWIN HULLS AND
FLOW OF WATER BETWEEN THEM



SCOUT

DRIFTWOOD

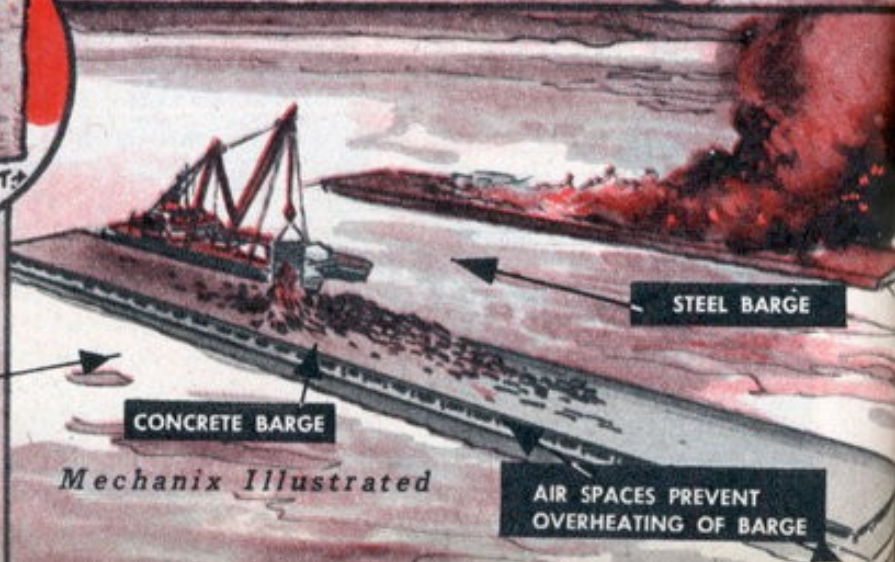
SHEAVES CONTROL
RAISING AND LOWER-
ING OF NETS THROUGH
HYDRAULIC SYSTEM

ENGINEERS' SPEED-
BOAT TOURS NEW
YORK HARBOR IN
DAILY SEARCH OF
DRIFTWOOD PACKS

UP TO 1,000,000 CU. FT.
OF DRIFTWOOD HAVE BEEN
COLLECTED IN ONE YEAR



L. H. REAVIS



STEEL BARGE

CONCRETE BARGE

DEBRIS UNLOADED ON
NEARBY ANCHORED
BARGES IS CON-
TINUOUSLY BURNING

AIR SPACES PREVENT
OVERHEATING OF BARGE

Mechanix Illustrated



BOOM LIFTS
10-TON WEIGHT

NET HOIST-
ING CABLES

AFT NET NOW
RAISED, IS LOW-
ERED TO COLLECT
DRIFTWOOD AFTER
FORWARD NET IS
FILLED

STEEL NET COM-
PARTMENTS WITH
TOTAL CAPACITY
OF 1100 CU. FT.

FORWARD NET
IS LOWERED,
SCOOPING IN
DRIFTWOOD

INJURIES
TO SEAPLANES

INJURIES
TO THIN-
HULLED CRAFT

FOULING
OF SHIPS'
PROPELLERS

CHIEF VICTIMS OF
NEW YORK HARBOR'S
CONSTANT PLAGUE
OF DRIFTWOOD

WINGS FOR GUIDING NETS
IN HOISTING OPERATION

PROPOSED SELF-PROPELLED CATA-
MARAN-TYPE DRIFTWOOD COLLECTOR

Driftwood Pickup

Army engineers have contrived a twin-hulled vessel that
ploughs right into harbor driftwood and carries it away.

October, 1947

Turn page



Present equipment. Here, collecting vessel by the barge it has filled. Below, men assembling driftwood within the towed net.

UNCLE SAM'S Army engineers have devised a floating "hyacinth machine" and a "snag remover" to eradicate persistent evils in inland waters and now, facing the increasing menace of driftwood in New York's harbor, they have contrived another marine contraption which, like a steam shovel's bucket, ploughs right into its objective and carries it away.

The operation is beautifully simple. Utilizing the twin-hulled principle of the catamaran, the new "self-propelled driftwood collector"—for whose construction bids have recently been asked—will have two walled-in wells, forward between the hulls, in which strong steel [Continued on page 179]

Driftwood Pickup

Driftwood Pickup

[Continued from page 74]

hydraulically-operated nets are suspended from fore-and-aft transverse bars. The nets when lowered serve as scoops. When the vessel charges into a flotilla of driftwood the nets trap and scoop it up.

Look at the picture. The forward net, lowered into the water, forms roughly the shape of the letter L with the open part ahead. As the vessel moves into the driftwood pack, fragments caught between the advancing prows of the hulls are forced into the gaping mouth of the front net, while the water swirls easily back between the hulls to emerge at the stern. There's no need to stop the craft, no obstacle from pent-up water. The second net, just behind the first, remains elevated, inactive, until the front net becomes sufficiently loaded and is raised; then it repeats the scooping process.

Note the cables hanging from the booms. Those hooks engage in loops on the net bars. When the nets are filled and crew members have secured a degree of order in the jumble of drift pieces the "hoist away" signal is transmitted to the control room; then the winches turn and the straining cables rise. Rollers on the bars' extremities neatly follow small tracks inboard from the "wings" of the walls. The load, stabilized, is swung over to a barge by the boom and, with the release of one end of a net, its contents are quickly dropped. This means that after the nets have been filled the vessel must dispose of their contents before the process of refilling can be resumed.

Let's go back to the beginning. Whence comes this driftwood? Why is it so dangerous that back in 1915 an act of Congress provided funds for its detection, collection and elimination? Oddly enough, very few persons, even around New York's waterfront, know the answers.

From far up the Hudson river, from various streams emptying into New York's Upper and Lower Bays, and from some of the wharves of the harbor come the miscellaneous planks, logs, fragments from rotting wharves and piling, wooden boxes (illegally thrown into the water), and occasional animal debris. Tossed by wind and tide, masses of material tend to accumulate. Much becomes water-logged, scarcely visible on the surface. In the greatest port in the United States this means danger. Finely-tapered ships' propellers may become fouled, blades broken. Thin-hulled plywood craft may be holed. Aircraft alighting on the East River and taxiing toward seaplane and amphibian ramps are endangered.

Wartime shipping first threw a searchlight on the driftwood menace. Vessels were then specially used to "sweep the streets" of the

[Continued on page 180]

Stop CRACKS IN CONCRETE FLOORS

this
way:



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How Will You Talk to the Martians?

**How can thought be exchanged?
Maybe they haven't got mouths!**

BY WILLY LEY

BEFORE long Earthmen are going to Mars. On Mars they may find civilized beings of one form or another. These beings will have a language utterly different from those of earth. How can there be talk? How can there be understanding? How can communication be begun?

Here lies a special problem.

The first suggestion of how we might communicate with other worlds was made just one century ago. It was not made by some wild-eyed crackpot, but by one of the very great men in the history of science. He was the top mathematician of his time and possibly of all time—Karl Friedrich Gauss.

Of the other planets of our solar system, Gauss said, the two which are closest to us, Venus and Mars, seem to resemble earth very much. If they do they might harbor life, he continued, and if they harbor life they might harbor intelligent life forms, the equivalent of man on earth. The way to find out is to send them a signal which proves to them that we are intelligent and which invites them to reply, to prove their own existence and intelligence. Of course our signal will have to be of such a nature that it cannot be taken for an accident of nature. A gigantic beacon, for example, might be considered only a volcanic eruption. Our signal will also have to be one which has meaning to them as well as to us. A gigantic mound which forms the letters A B C would mean something to us, for example, but not a thing to a Martian or a Venusian; it would even be meaningless to most Chinamen.

Gauss, pondering this problem, came to the conclusion that our signal had to be a mathematical figure and nothing else, and he selected the one made famous by Pythagoras, the triangle with a square over each side, proof that the square of the hypotenuse equals in area the sum of the other two squares. If the Martians or Venu-

sians are intelligent enough to have progressed to simple geometry they must know this figure, and it must mean the same to them as it does to us.

The next problem was how to produce a mathematical figure of the necessary size, and here Gauss had a brilliant idea. He suggested making it of dark pine forests planted in the Siberian tundra in strips several miles wide and up to a hundred miles long. The interior of the triangle and the squares would be planted with wheat, for contrast. Aside from its mathematical





meaning such a design could never be accidental, for nobody would plant things in such a crazy pattern with so much waste of space unless there was a good reason for it.

Gauss' idea may never be carried out now, for it looks as if we will land a rocket ship on Mars or Venus first. Suppose our interplanetary explorers encounter intelligent life on Mars—creatures at just about our level of progress (of necessity we would have progressed somewhat farther, or else *they* would visit *us*) and having

If there is a Martian civilization, and one at earth's level, the one thing common to both will be mathematics, so communication will have to start off with the teaching of our arithmetic.

about the same set of sense organs. How will we communicate with them? First we will want to "get across" the simple fact that we are visitors from earth. We will not be able to talk to them. We might never be able to talk to them, because they may not be capable of emitting articulate sounds. How can we—assuming that they can see

The symbol of the arrow is likely to be meaningless (or it may have another meaning to them), therefore we will repeat: picture of earth and its symbol, sketch of human being, rocket ship, symbol of Mars and picture of Mars with its two small moons.

Finally there will be a representation of the solar system with a broken line showing the orbit travelled by the rocket ship.

The remainder of the "letter of introduction" would be simply a picture book of things terrestrial, beginning with those which the men have with them, so that they can show a wrist watch, for instance, when the picture of a wrist watch comes up.

Such an introduction would be understood by any intelligent creature that can see. We can't be sure we'll find any, so as to make use of it, but we can hope! •

To "tell" the Martians that they are from earth our visitors will have to "get across" with their math and the sketches below the following set of ideas: A, the relative positions of earth and Mars in the solar system; B, the order of the planets and their satellites; C, our symbols for the planets; D, self-identification; and E, the course they took in coming to Mars from earth.

$$\therefore + \therefore = \therefore \therefore$$

$$3 + 4 = 7$$

$$10 - 4 = 6$$

$$3 \times 7 = 21$$

$$16 \div 8 = 2$$

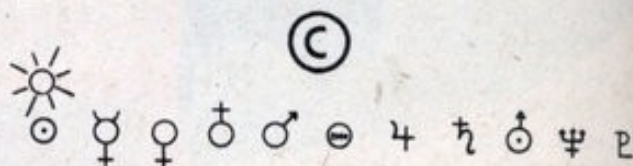
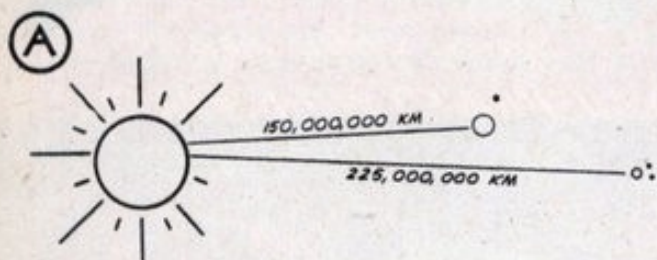
$$10 - 4 + 3 = 9$$

$$\square = \boxed{1} = 1^2 = 1$$

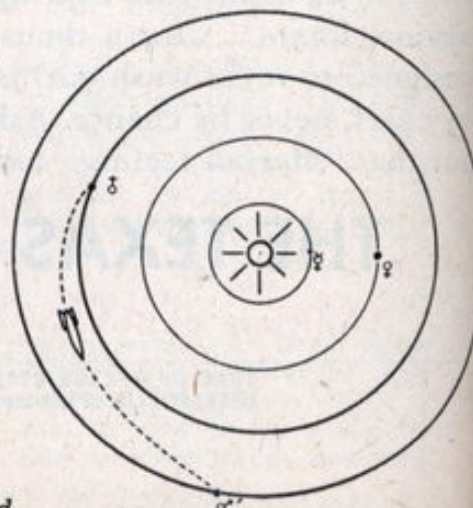
$$\boxplus = \boxed{2} = 2^2 = 4$$

$$\boxtimes = \boxed{3} = 3^2 = 9$$

The Martians will have to learn addition, subtraction, multiplication, division, powers. By counting dots they'll learn our digit symbols.



(E)



Yankee Ingenuity Vs. Hitler!

by Major 

Malcolm Wheeler-Nicholson

Noted Military Expert. Author of "America Can Win" and "Battleshield of the Republic."

AT THE precise moment that Herr Adolf Hitler finds himself actually face to face with an American fighting machine, the Fuehrer, who has some little reputation as a wizard of war surprises himself, is going to get the surprise of his life.

For Mr. Hitler's war plans have not taken account of one intangible in the complex which is America: Yankee ingenuity!

For more than 150 years, American ingenuity has lead the advance of science—not

Our artist's conception of bat-man troops, soldiers who will wing their way almost to earth before opening their parachutes to land easily, grouped and ready for action!



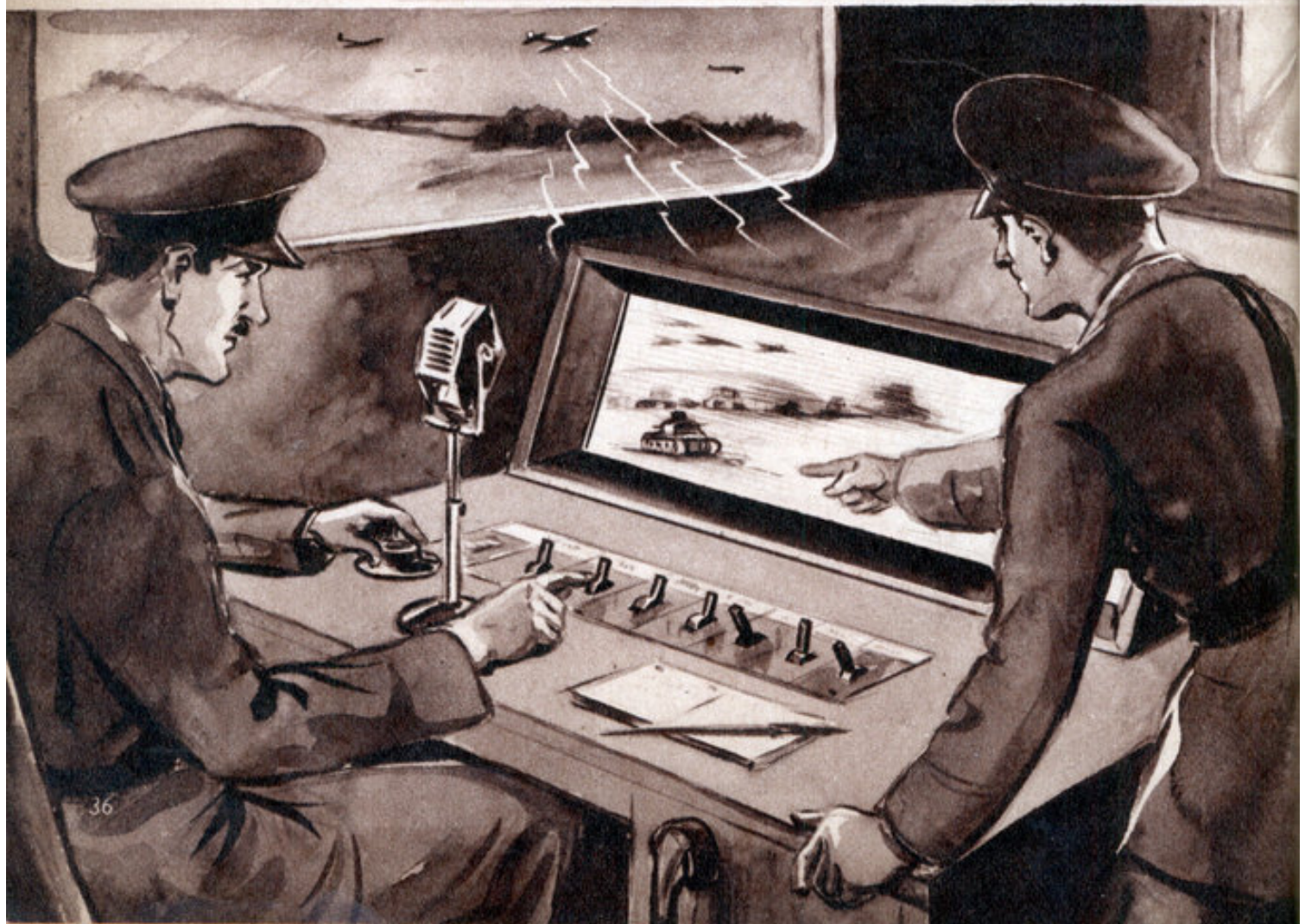


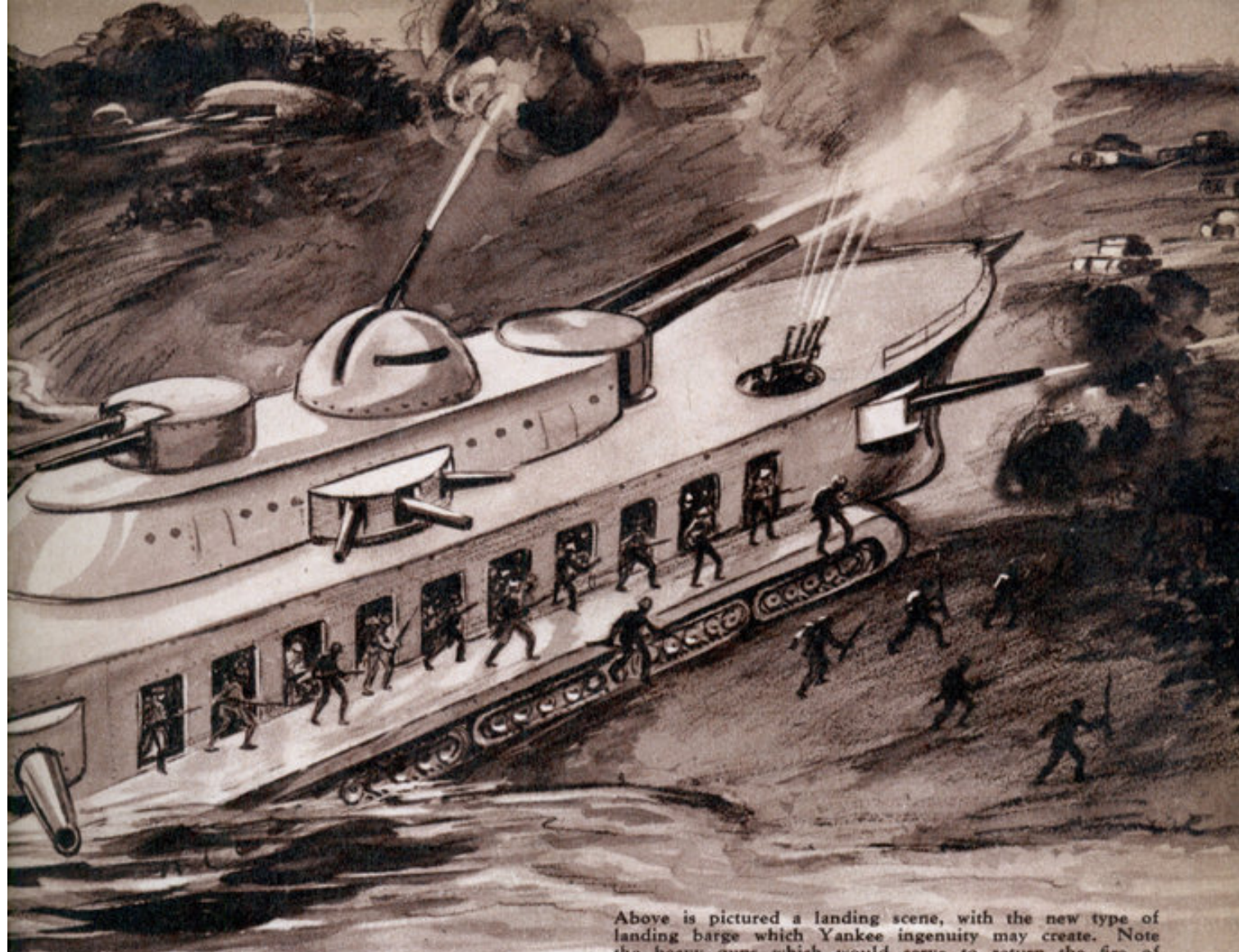
only in peace pursuits, but especially in the art of war.

The record shows that always, in the pinch, the Yankee has come through with some new and startling weapon or war method.

For America has been built upon imagination, adaptiveness and mental agility. The continent was first peopled by adventurous

Below: Modern mechanized warfare has rendered ordinary military maps archaic. Our artist envisions a television field map with observation planes broadcasting the image of enemy tank columns back to field headquarters, giving an actual picture of operations!





Above is pictured a landing scene, with the new type of landing barge which Yankee ingenuity may create. Note the heavy guns which would serve to return the fire of heavy coast defense batteries.

souls who dared to look over awesome horizons and push into the unknown. The Nation was made by revolutionary thinkers. It became the wealthiest in the world by developing a new race of men: a race of traders and tinkerers with an original and inventive turn of mind—the same type of people who today make up the readers of **MECHANIX ILLUSTRATED**.

Pessimists and cynics have been saying that America can't do it—that the spirit that built America and made it rich beyond dreams is dead. The pessimists and cynics, however, haven't any lathes or workbenches of their own; they don't putter in the basement; they have lost touch with the real people of America, the people who still actually do things with their brains and their hands. These people know that America can do it!

What does the record show? A quick glance at American history reveals this panorama:

A band of Revolutionary soldiers making a forced march through the forests, spreading out as skirmishers behind trees and bushes, and routing the precision trained, solid-marching ranks of Europe's best army—a new

tactic so startling that British generals complained bitterly of it, declaring it was "unfair"!

In 1836, Samuel Colt produces the famous revolver "that won the west," with standardized ammunition—changing all concepts of side-arms.

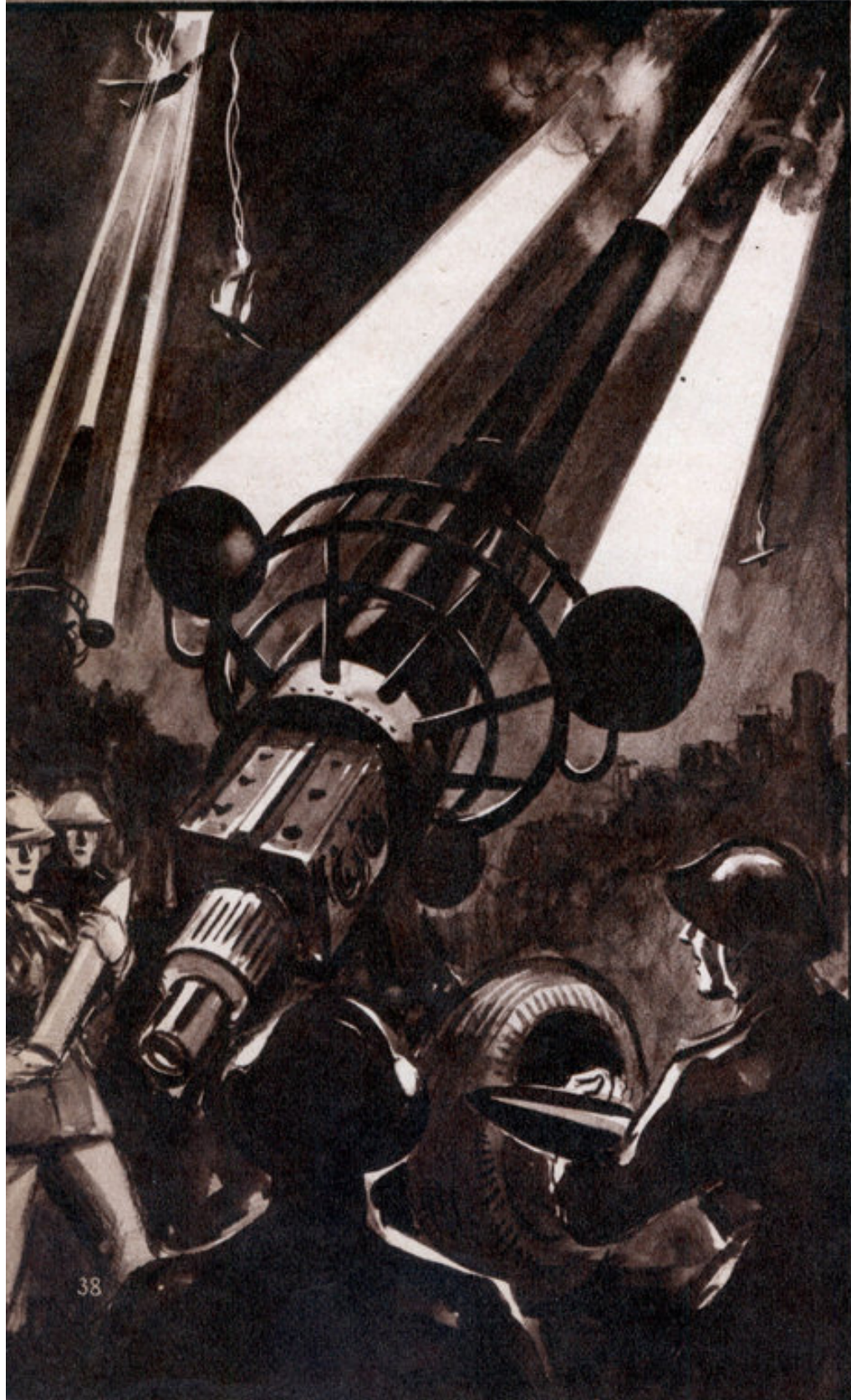
On March 9, 1862, the Monitor and the Merrimac meet in Hampton Roads, Va., and not only blasted each other—but also blasted every other warship in the world. They were the first armored battleships in history and their engagement rendered all the wooden battleships in the world immediately obsolete.

In 1861, Dr. Richard Gatling invents a rapid firing gun, the Gatling gun—and makes all the military theories on fire power archaic.

In 1895, Charles Duryea builds what is generally conceded to be the first successful automobile—and paves the way for all the mechanized armies of today.

Shortly before the turn of the century, Simon Lake and J. P. Holland produce the first successful submarines—a weapon with which the Germans very nearly won the last war.

In 1903, the Wrights fly their first airplane—



Our artist's conception of a heavy torpedo, loaded with enough explosive to annihilate a dreadnaught, which is guided toward its objective by a high-speed motorboat that detaches itself and veers off when it is close enough to insure a direct hit on the battleship.

the precursor of the *Luftwaffe*.

In the early 1900's, Benjamin Holt conceives the caterpillar tread for a tractor—making possible the *panzer* divisions of today.

In 1912, an American, Captain Berry, makes the first parachute jump from an airplane—and foreshadowed the modern 'chute troops.

This is only a peep-show panorama of the military advances which have been made possible through American ingenuity. There have been dozens of others — barbed wire, to mention one more. Americans produce more than 50,000 patents a year. Among them have been thousands upon thousands of military improvements. It can safely be said that any major mili-

Left: Using ultra short wave radio beams which sweep the sky and "bounce back" when they encounter an enemy aircraft, this envisioned aircraft detector would automatically aim the anti-aircraft gun on which it would be mounted.

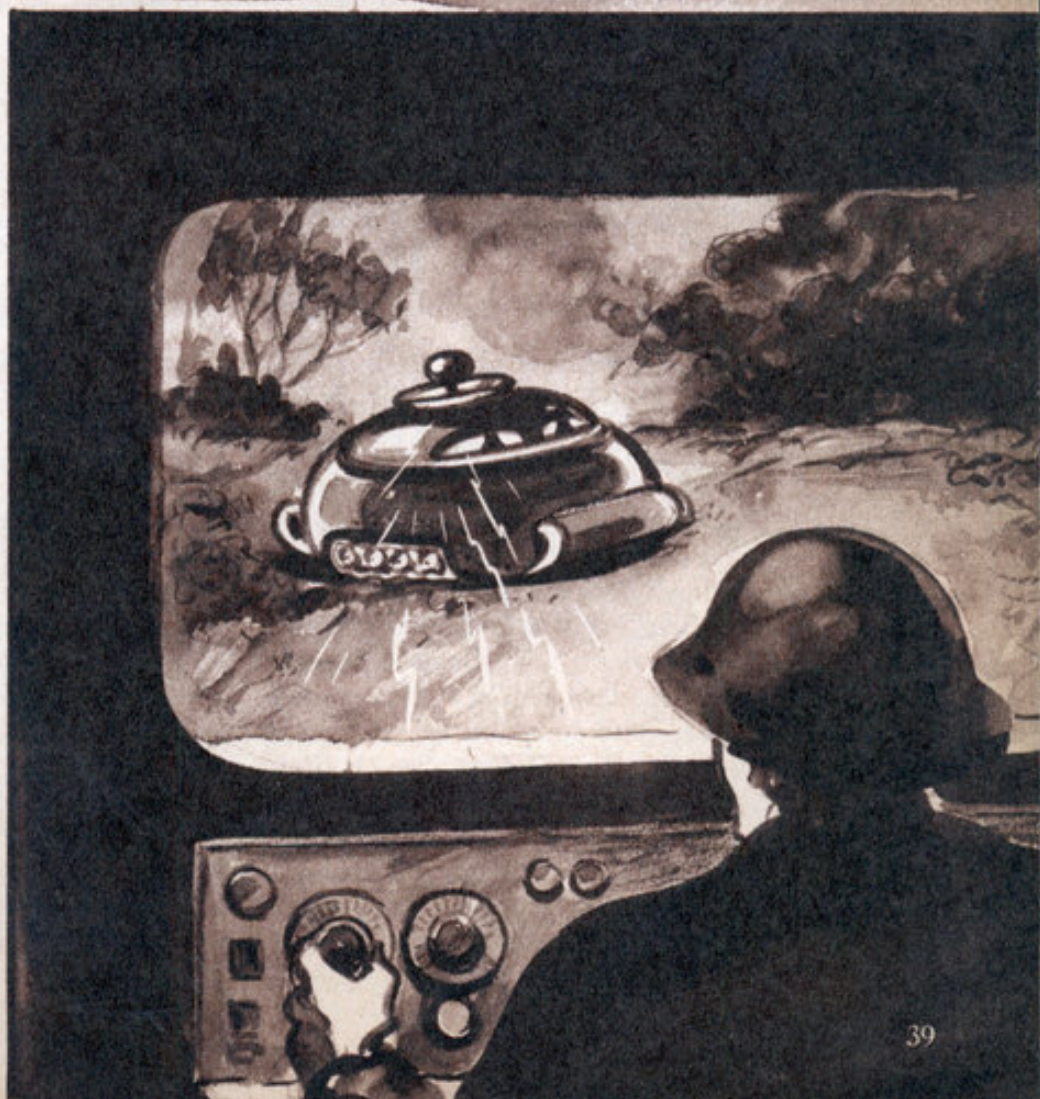


tary mechanism existing today can be traced directly or indirectly to American technical cleverness.

It can certainly be said, without danger of argument, that none of the war machines of today would be in existence had it not been for the exclusively American development of mass production.

The American Navy invented dive-bombing, just as the Army invented parachute troops—later adopted by the Russians. America has produced what is undoubtedly the most accurate bomb-sight in the world. Air-cooled radial motors on which today's bombing planes depend for power, smokeless powder, machine guns, automatic rifles

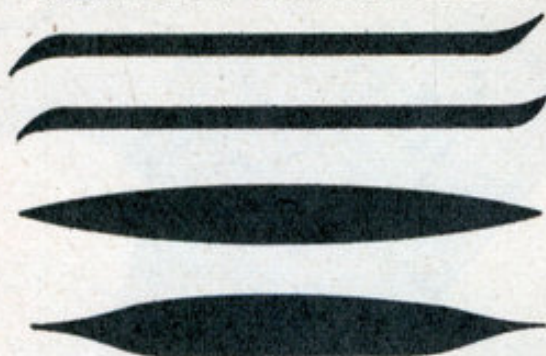
[Continued on page 142]



Right: A radio controlled, moving land mine, as our artist has drawn, could be directed against enemy fortifications from a safe vantage point, either a tank, or a fixed control base.



CONVENTIONAL AIRFOIL
(THICK SECTION - BLUNT LEADING EDGE)



SUGGESTED SUPERSONIC AIRFOILS
(VERY THIN SECTION - SHARP LEADING EDGE)

FAIRING CONE OF RAM
JET RETRACTED

LANDING ROTORS RETRACTED
INTO OUTER SKIN OF CABIN

ROTOR HEAD
FAIRING
DOORS

PRESSURIZED
DOUBLE-DECK CABIN

SUPERSONIC SECTION AIRFOIL WING

ATHODYD JET
POWER CUT OFF

ROTOR UNITS EXTENDED
FOR SLOW, CONTROLLED
LANDING APPROACH

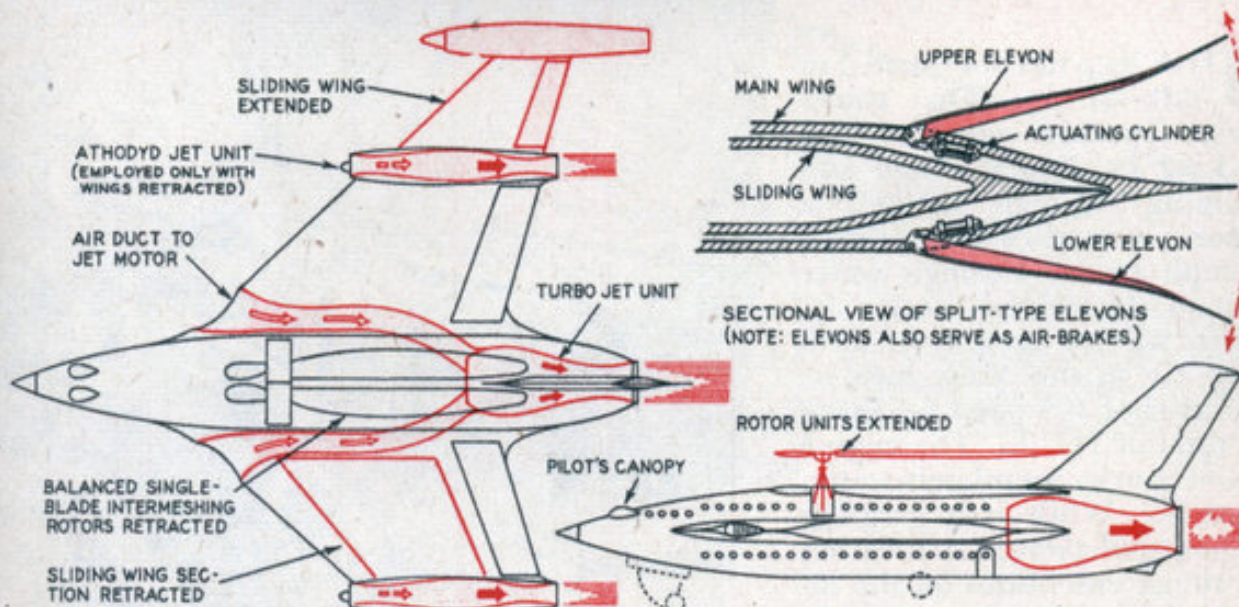
ELEVONS IN
"BRAKING"
POSITION

Douglas Rolfe, nationally known aircraft artist, draws the probable shape and shape changes of tomorrow's supersonic airliner as it flies at ordinary speeds (right) and at supersonic speeds (top).

SLIDING WING SECTIONS RETRACTED
AND RAM-JET POWER TURNED ON

TURBO-JET
EXHAUST NOZZLE

DOUGLAS
ROLFE



Note in diagrams and drawings that at lower speeds the wing panels are extended, and the helicopter rotors and turbo-jet unit employed.

At supersonic speeds the wing panels are retracted, the rotors fit snugly inside the fuselage, and the athodyds or ram-jets take over.

this is the *Supersonic* barrier

Extraordinary things happen close to the speed of sound.

FOR millenia man dreamed about flying—and did nothing about it. In 1783 the balloon was invented and people could fly wherever the wind happened to blow them. More than a century later the airplane was invented—and people began to be able to fly where they wanted to go.

Now, forty-four years later, man wants to fly faster than sound. He will do it. Aeronautical science is close to this goal; it may take only a year or two. But there are difficulties, and most of them are tied up with something which is called a Mach number. (The term honors the Austrian physicist Dr. E. Mach, who was one of the first to investigate the problems of air resistance at high speeds.)

The Mach number is a convenient means for expressing an important ratio in one word: it's the relationship between the speed of something—car, airplane, rocket or bullet—and the velocity of sound at the same altitude. Note: at the same altitude. This is important, since the velocity of sound is 765 mph at sea level but 100 mph less at 40,000 feet. To say that a plane flies with Mach number 0.5 means that it has just half the velocity of sound at the altitude where it happens to be.

Because the velocity of sound decreases as we go up in the air, a plane might have Mach number 0.5 at or near sea level, but Mach number 0.7 at high altitudes. And that is where the difficulties start. When its Mach number approaches 0.7 the air

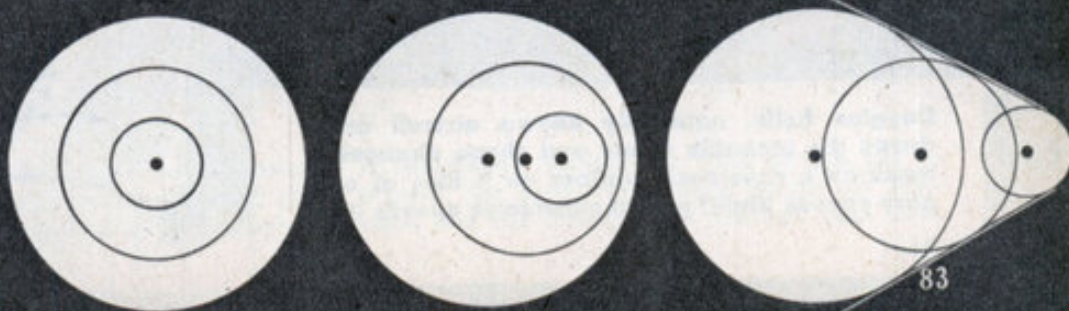
**BY
WILLY LEY**

Bottom view of the de Havilland "Swallow," showing its arrow-like sweepback.

begins to behave differently. Instead of smoothly flowing around the wing it tries to pile up, and at corners and surface irregularities the air gets into its own way, so to speak, and builds into a shock wave; and when the speed (and of course the Mach number) grows large enough there are additional shock waves where the air-flow begins to separate from the wings. All this makes for big trouble at trans-sonic speeds.

At this point we'd better define a few terms. At Mach numbers of 0.65 or less (about 500 mph or less) airplanes are said to fly at *subsonic* speeds. At Mach numbers of 1.3 or higher (say, 1,000 mph and up) they are said to fly at *supersonic* speeds. The interval between the two is called *trans-sonic*, and that is the region now under attack. The fastest planes are already in the lower reaches of that range. The Mustang [Continued on page 96]

Diagrams show: left, a disturbance center that is motionless, relative to air; middle, a disturbance center moving; and right, a disturbance center moving fast.



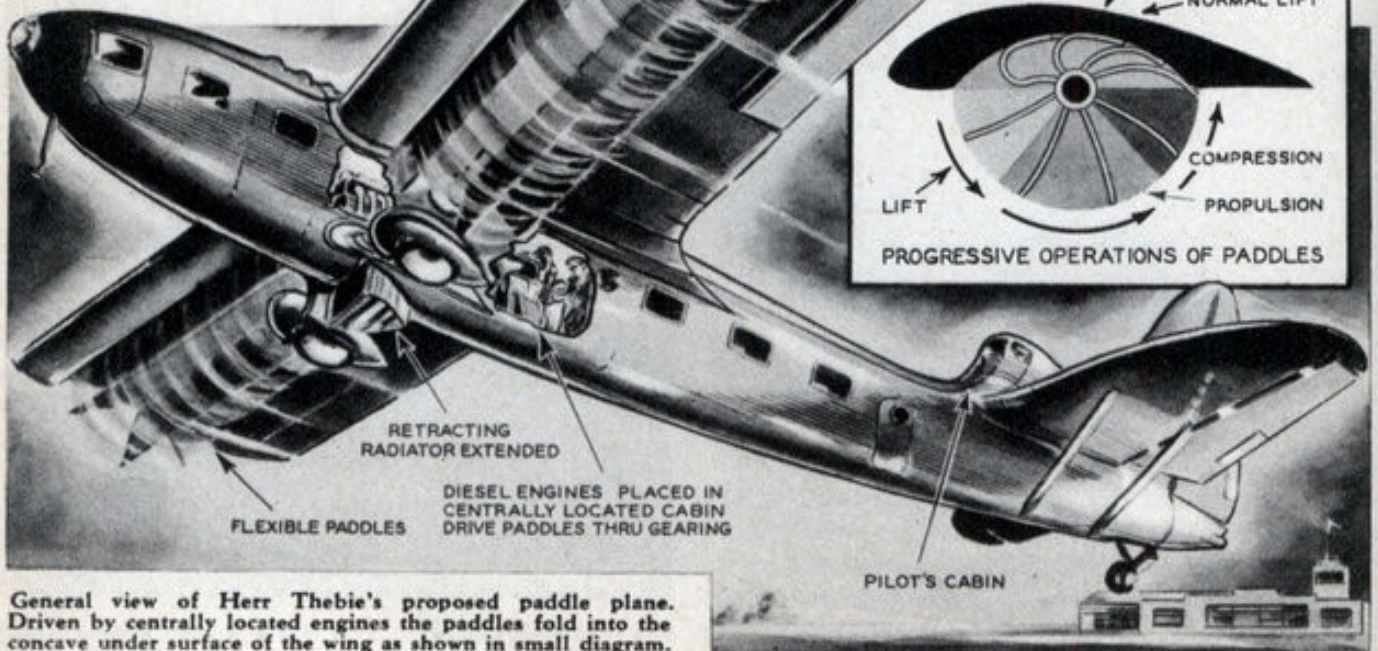
Sensational German Paddle Plane Built On "Flapping Wing" Principle

FROM Germany comes the news of another attempt to produce a plane of the rotating wing, or "paddle" variety. Unlike the well-known Dr. Rohrbach's paddle-plane design, the latest attempt to get away from conventional airscrews as a means of propulsion does not depend upon the paddles as a sole means of lift as well as propulsion. Rather, it seeks to adapt the paddle principle to an otherwise normal airfoil.

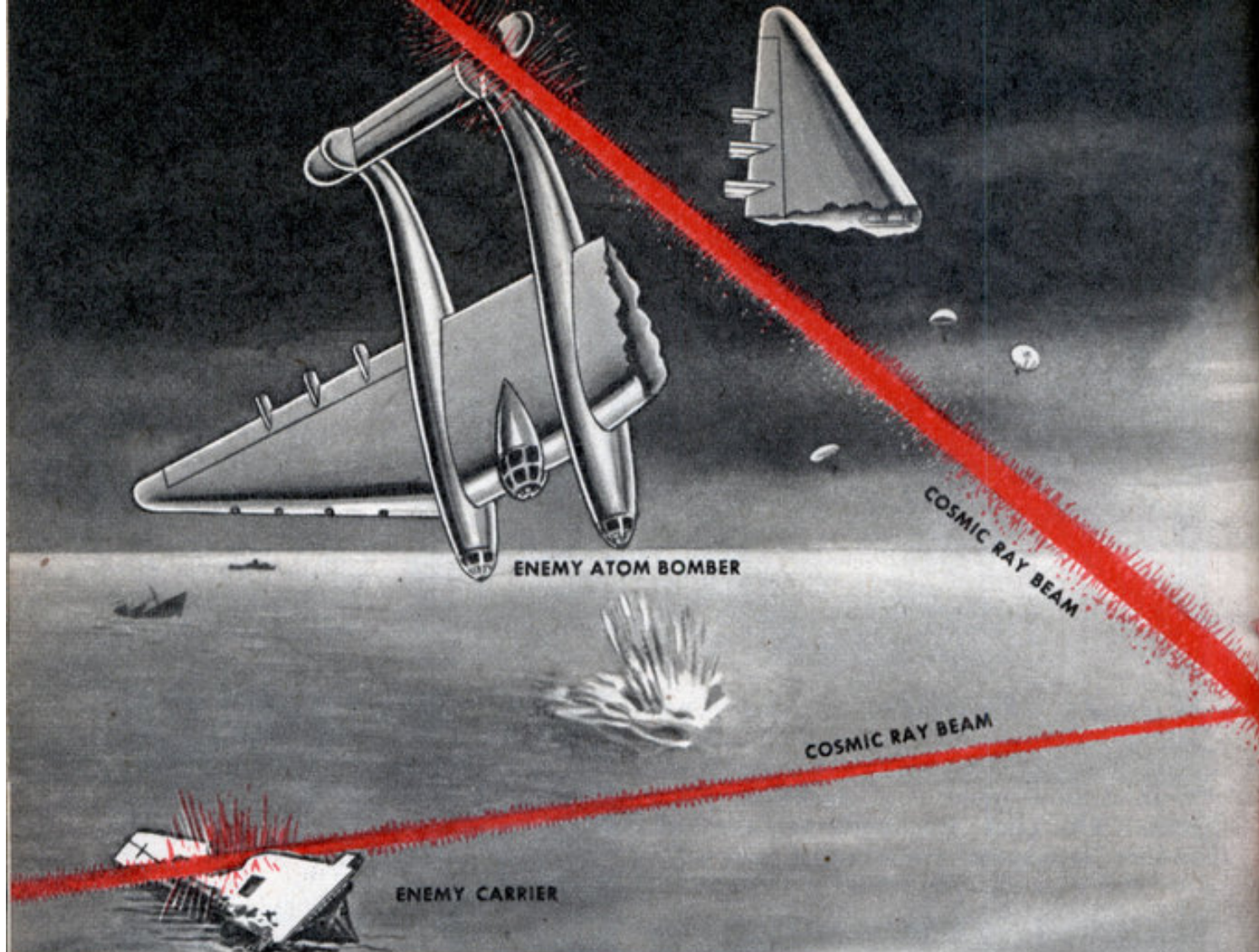
The inventor, Herr Engineer R. Thebie, of Chemnitz, after studying wing-flapping flight as practiced by birds, has introduced the results of his observations in his airplane.

The paddles project from the lower surface of the wing and, made of flexible material, fold up into the wing itself during the upper half of the revolution. The compression of air natural to a wing in flight is thus assisted. Emerging from the wing the paddles exert a downward and lifting force. As the rotation proceeds they exert a propulsive force.

Should the propulsive effort prove insufficient for practical purposes, Herr Thebie will install an auxiliary airscrew in front to aid the plane in taking off and other situations where exceptional power is needed.



The novel location of the pilot's cockpit affords a striking example of divergence from accepted design. Seated thus at the tail of the plane, the pilot has a commanding view of structure beneath him.



BY LOUIS BRUCHISS

DESPITE vehement reiterations that the atomic bomb is the absolute weapon, a conviction has been growing that Einstein's original equation $E=MC^2$ has not had its final say.

The very paucity of our knowledge of the complex nuclear reactions and of the origin of matter and energy itself, would at once suggest that there may be a weapon more encompassing and deadly than the atomic bomb.

Such a weapon could well be the cosmic ray-gun.

The possibility was hinted at recently by European cosmic ray scientists. The prospect is enthralling—and frightening. The cosmic ray-gun would be the first weapon ever to use trigger energy out of this world.

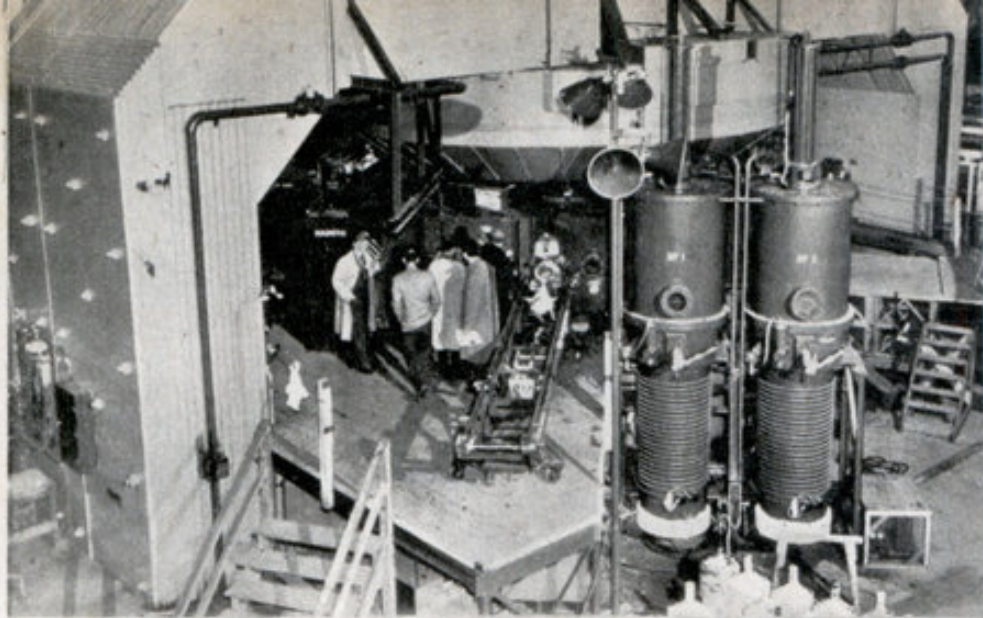
Cosmic rays have been the subject of deep research



COSMIC RAY-GUN

Atoms exploded by cosmic rays release far more radiation than is obtained by ordinary fission. Here's a potential death-ray!





Physicists and guests have a look at Berkeley's giant new 4,000-ton cyclotron which produces atomic bullets with energies of 200 million electron volts.

by investigators for the past two decades.

What are cosmic rays?

They are powerful particles of energy, originating as individual elements similar to light photons and electrons, which are shot like bullets from the vast unknown regions of interstellar space to all parts of the earth, day and night.

After entering the atmosphere at tremendous velocities, the streams of cosmic ray particles collide with the nuclei of atoms of air, bursting them apart and imparting to the particles so formed even higher velocities than the original particle had.

The particles produced through such cosmic ray-atmosphere collision are about 200 times the mass of an electron and are known as mesons.

Each minute every human being on earth is being hit and penetrated by thousands of these mesons. The individual one has measurable energies up to as much as two billion electron volts. Since the gamma rays of an atomic bomb explosion are only two million electron volts, cosmic ray energy may therefore be a thousand times greater than any produced so far on earth.

Fortunately the density and duration of life of the rays is low, far below the point where they can do harm to human beings.

But how would one go about constructing a lethal cosmic ray-gun using these mesons?

A beginning has already been made in the United States. University of California scientists, leaders in building cyclotrons and other atom smashers,

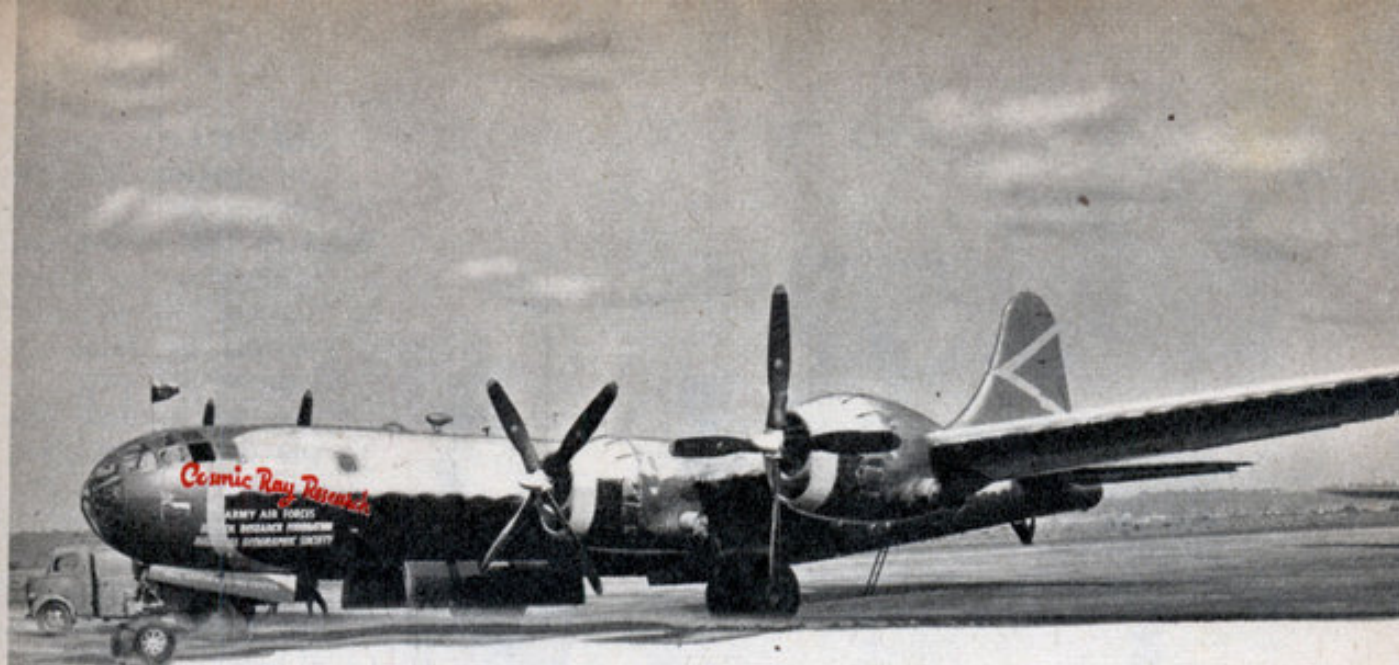
have constructed an experimental "linear accelerator"—an atom cannon that hurls a stream of protons, the nuclei of hydrogen atoms, in a straight line instead of in the spiral orbits of the lesser energy particles of the cyclotron. This means that the apparatus will energize the atomic projectiles toward the billion electron volt mark and places them in the class of cosmic rays.

The unit is only 40 feet long and is flanked by batteries of obsolete radar sets, 15 of which are installed at equidistant spaces along the outer copper tube of the accelerator. Inside the tube is a sectioned, rifle-like barrel through which the protons are shot. As they pass each section of the inner tube they are accelerated or given a "push" by the respective high-frequency radar outfits, to finally emerge at about 40,000,000 electron volts at the muzzle.

After this initial model has been fully tested, a larger pilot model, 280 feet long, with seven 40-foot sections, will be built. To reach cosmic ray intensity it is estimated that an apparatus 1,000 feet long would be required.

Obviously this length would be impractical in modern warfare, but it is not unreasonable to suppose that still more powerful electronic energizers can be made to impart still more billions of electron volts of energy to the protons, all within the confines of gun barrels of usual length.

Once this is accomplished, we will have a usable cosmic ray-gun, the first real death ray. Such a gun could be mounted in heavy bombing planes, in



B-29 cosmic ray laboratory, used in flights from Canada to Peru.

controlled or satellite rockets, or on any high vantage point, and aimed at the enemy day and night. It will emit no sound and no light; and no other evidence that it is functioning will be noticeable except the clicking of radiation counters that may be put in the path of the invisible stream.

The only protection against the cosmic gun will be extremely heavy shielding. Underground shelters are again indicated. Above-ground buildings will have to be guarded with lead or other barriers. Against one type of ray—rare, fortunately—it has been estimated that a thickness of as much as 75 feet of lead would be required! This particular ray has 10,000,000 times the radiation energy of the atomic bomb, according to calculations of scientists from the Barthol Foundation of the Franklin Institute.

Depending upon the energies used,

individual armored suits of high-density material might be feasible.

Unlike present guns which shoot projectiles strongly subject to gravity and of limited range, the cosmic ray-gun will project a death-beam able to travel in a nearly straight line for thousands of miles. If aimed at or near sea level, they will fly straight off into space, except as they are deflected by the earth's magnetic field or are absorbed by the earth's atmosphere.

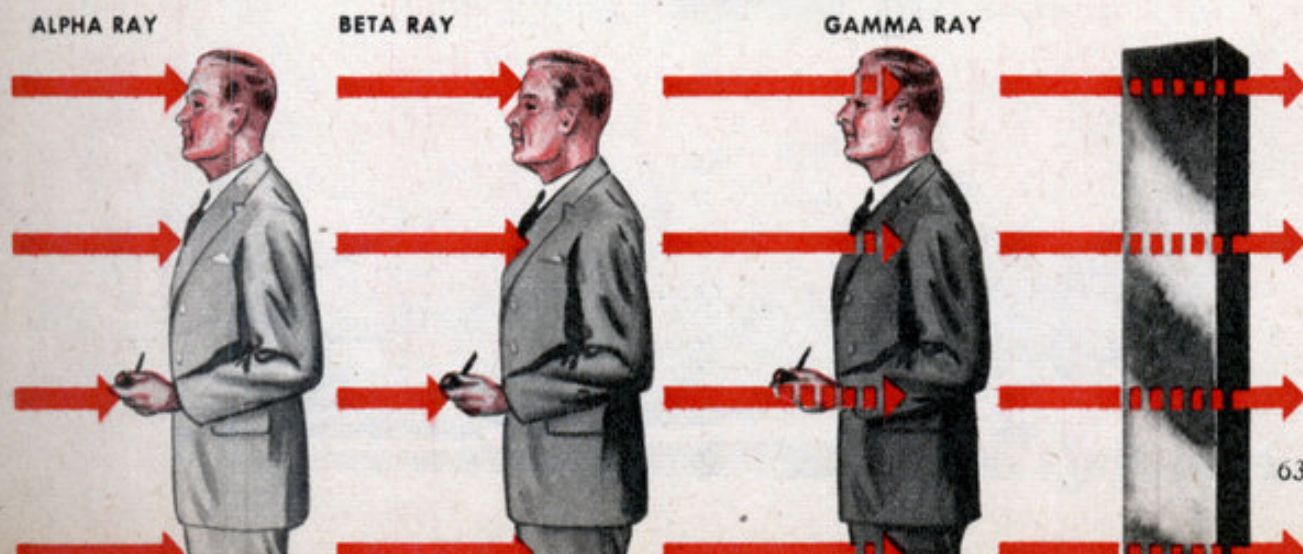
Because the atmosphere itself is the medium in which the mesons are created, the new gun will generate a new type of fission, producing, not the heat, blast and noise of an atomic bomb, but silent death-dealing radiation which would be extremely hard to evade.

Under radar-like sweeps from a mountain top or from guided missiles, animal and plant life would wither away.

The stream [Continued on page 162]

Relative penetration of A-bomb radiation. Alpha ray burns skin but is stopped by clothing; beta ray reaches blood vessels; gamma ray penetrates man and nine inches of steel.

RADIOACTIVE PENETRATION



Gyroscope Monorail Car to



The monorail car above has just been developed in England to provide fast transportation as a substitute for street car systems. Driven by propellers fore and aft this monorail developed a speed of 100 miles an hour in a demonstration near Glasgow. Guide rail prevents side sway.

RAILROADS may challenge the increased popularity of air travel by developing a superspeed monorail car. Balanced by gyroscope and controlled by radio, the gyroscope monorail would be capable of more than 300 miles an hour, its inventor claims.

The gyroscope, not a modern invention, has only recently been applied to transportation. It steadies ships in storm tossed seas. It aids in the automatic control of airplanes in flight.

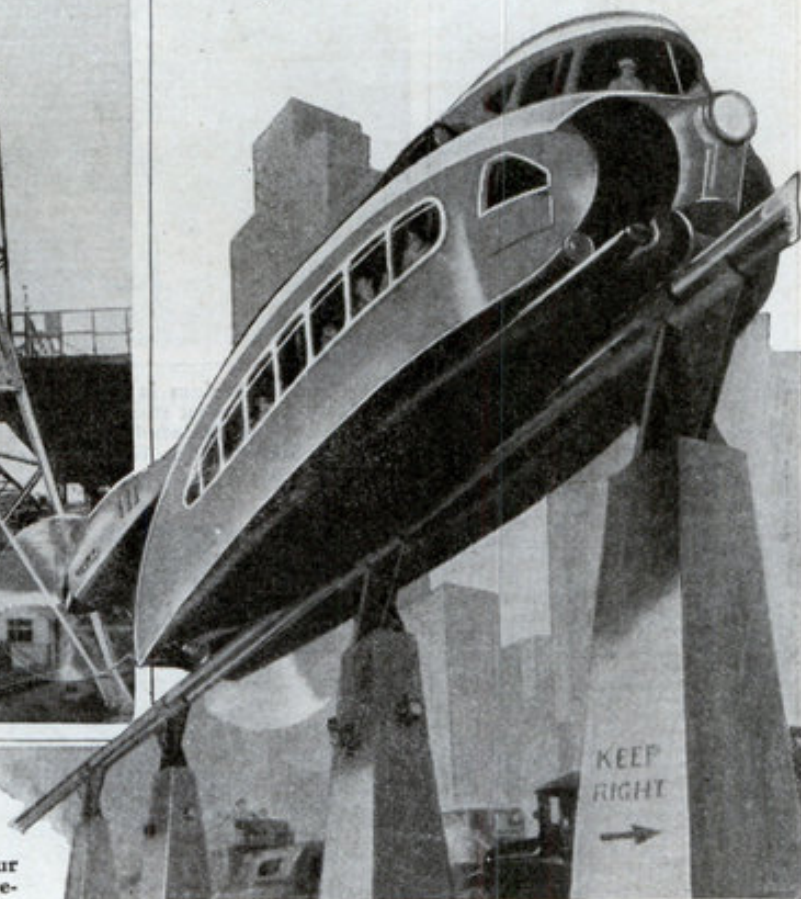
Applied to rail transportation, the gyroscope will permit much greater speed without sacrificing safety. In fact, Raymond C. Buchardt, engineer of the Telefunken company, of Germany, who designed the gyroscope monorail, claims his superspeed car provides greater safety than is now possible.

Car Stands Upright on Monorail

Buchardt's monorail has all the latest developments in streamlining and makes use of airplane features to guide the car on its single rail. The gyroscope monorail stands upright on its single rail, while present monorails are suspended from the rail.

The gyroscopes are used to balance the

This German monorail will revolutionize rail transportation. At 300 miles per hour it will meet the challenge of the air transport lines.



Engineer Buchardt's improvement over the English monorail is shown above. For street transport systems large steel structures would be unnecessary. Gyroscopes would eliminate a guide rail to stop side sway. Greater speed is possible.

car on this single rail. They do away with the side sway that would be present were great speeds attempted with the suspended monorail.

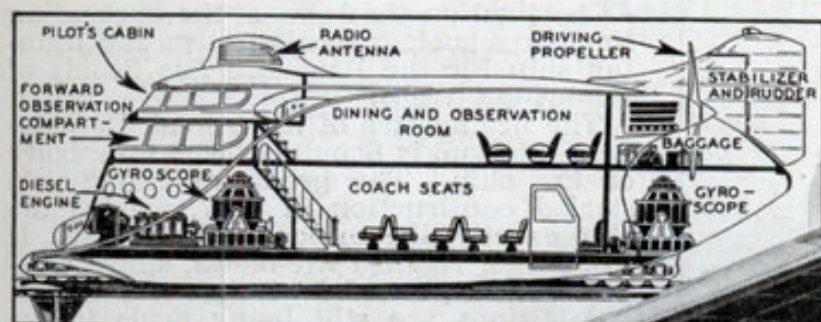
Radio Will Replace Block Signals

"Because of the terrific speed of more than 300 miles an hour, the ordinary block signal will be impossible for the transcontinental monorail," said Mr. Buchardt. "Signals would not be visible and in fog, rain or smoke the vision of the pilot would be entirely obscured."

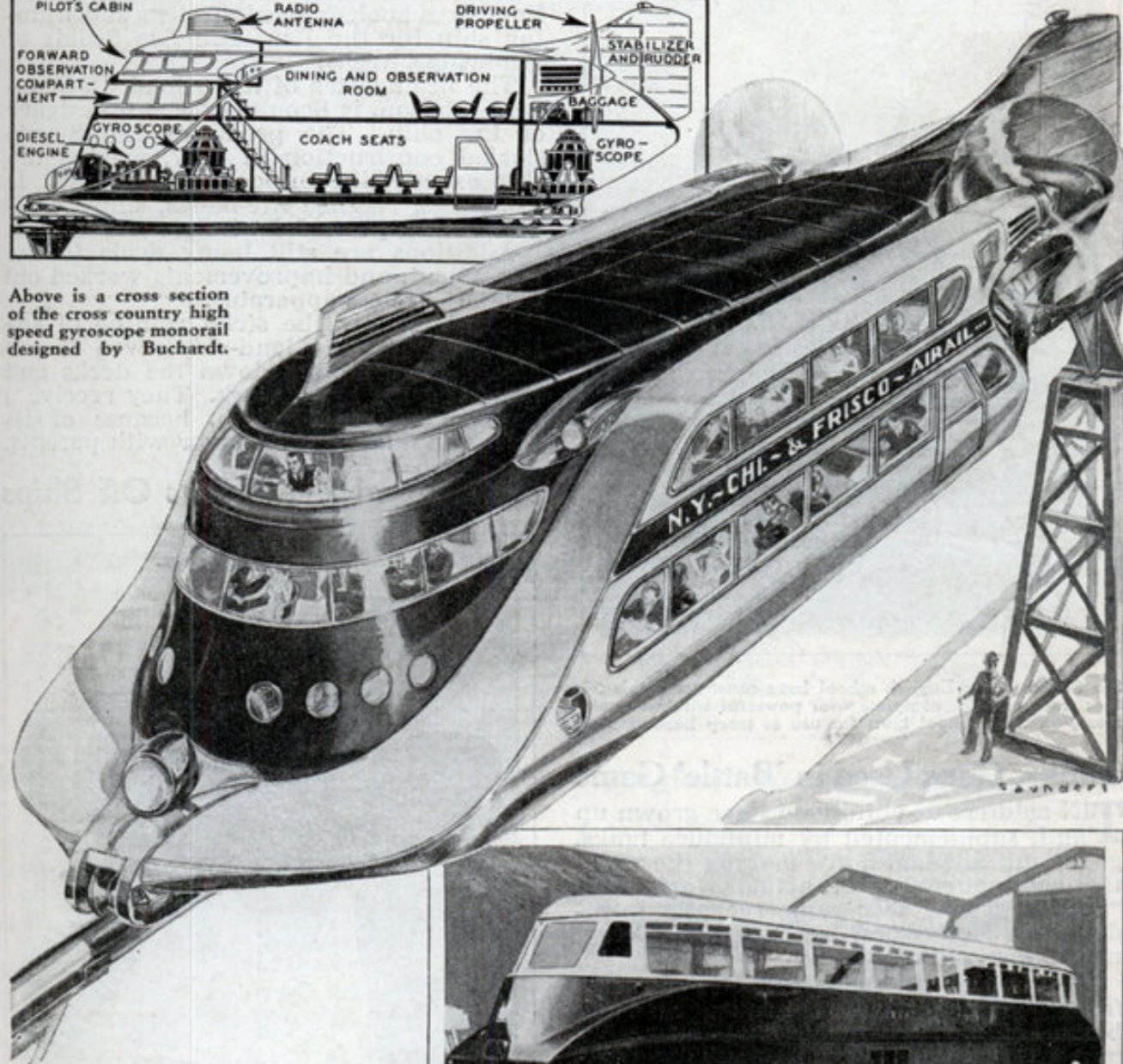
"To meet this difficulty I propose to use the radio to transmit signals and orders to the pilot just as transport planes are now controlled. Radio messages from a dispatcher's office would tell the pilot when to slow up and would warn him of any dangers ahead."

The enormous air pressure created by the great speed would throw an ordinary car from the rail. Buchardt has solved this problem by designing a long, sloping curve

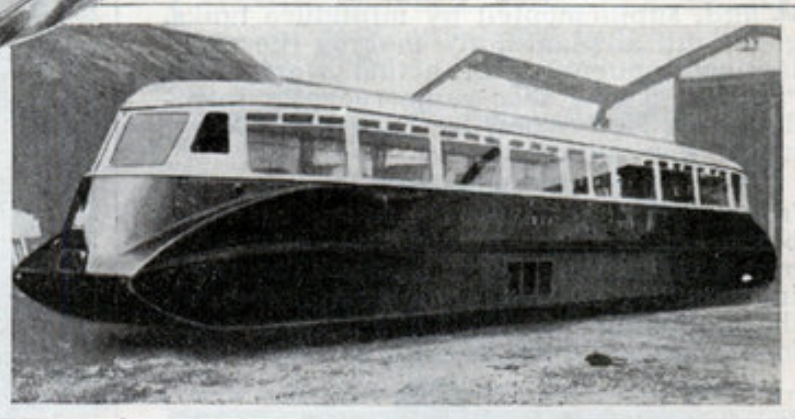
Travel 300 Miles an Hour



Above is a cross section of the cross country high speed gyroscope monorail designed by Buchardt.



The 300-mile-an-hour-gyroscope monorail is shown in the artist's drawing above. The long forward sloping planes hold the car to the rail. Radio signals would guide pilot.



This latest railroad car design follows the streamlining used on the gyroscope monorail. This English rail car attained a maximum speed of 60 miles per hour.

on either side of the car, which he calls a "wind catcher." The air pressing against this "wind catcher" would hold the car on the rail.

In his experiments with his invention, Buchardt found that the monorail would have trouble taking curves. The car took the curve perfectly, but the centrifugal force nearly threw it off the rail after completing the curve.

For that reason stabilizing fins were placed at the front and rear of the car along with a large rudder. The forward fin also houses the radio antenna.

The gyroscope car is driven by two large propellers at either side of the rear end of the car. One gyroscope would be housed in

the forward end of the car and the other in a rear compartment. Power would be supplied by Diesel engines.

The rail used would be round and the wheels curved in such a way as to form a ball link.

The traction system type of monorail would be much smaller than the car used in cross country runs. The latter would be a double-decked car with the pilot housed in a third deck forward.

The trans-continental type would carry approximately 100 passengers.

STEREATRONICS

A New Science that Will Change Your Way of Life



TV set of the future (as designed here by GE) is thin enough to hang on wall

Tiny solids are turning the electronics industry upside down. Some vibrate, others change light to energy or energy to light, or direct current to alternating. Together, they spell revolution



Simple solids like these, some almost microscopically

By CORNELIUS RYAN

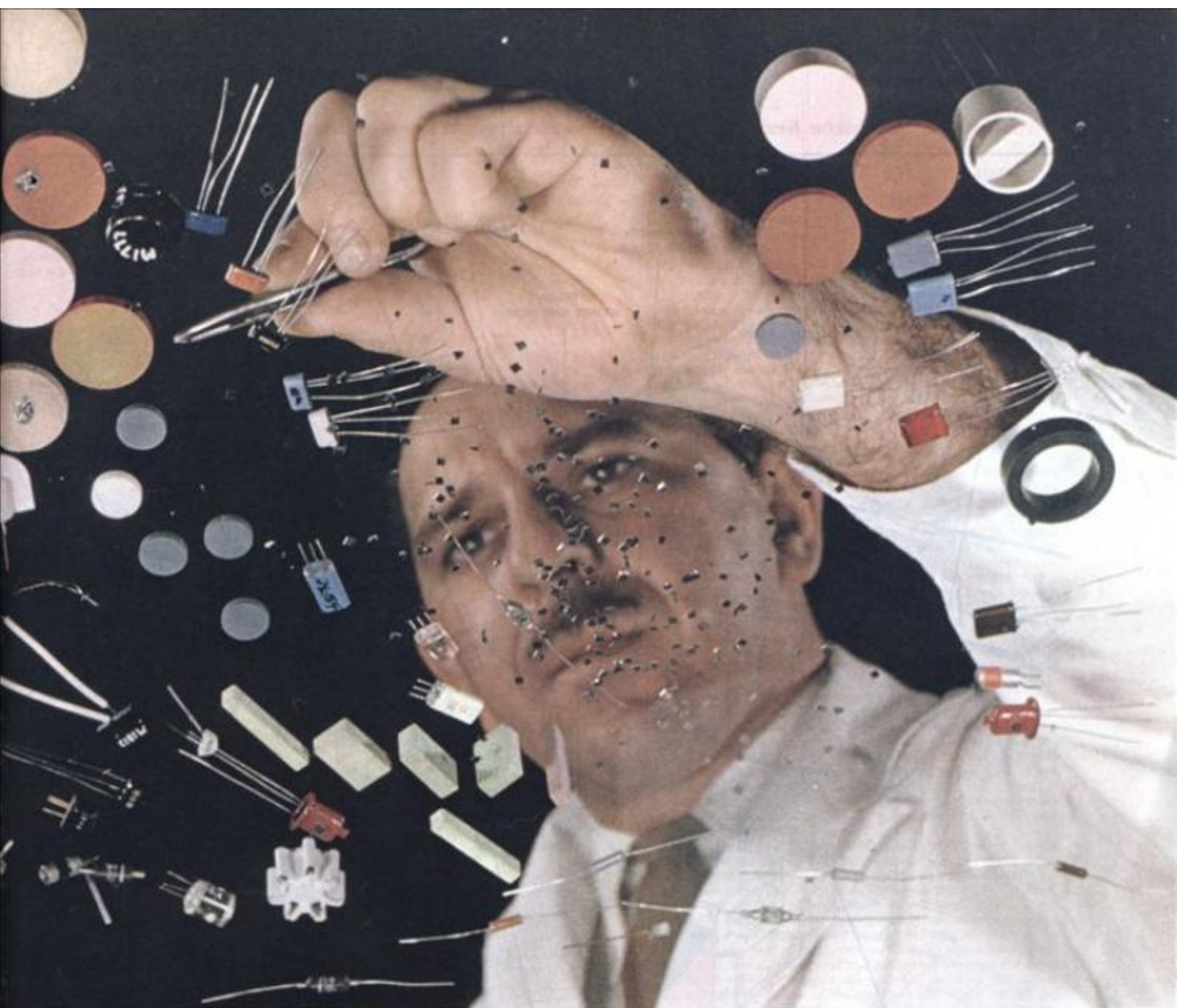
A NEW science, stereatronics, has been creeping up on us in the last few years and has started to make major changes in the way we live. Few of us have noticed any difference; the changes have come so quietly that even many of the people who are closest to the new science are surprised at what it has been doing. Yet the evidences have been all about us.

—Television sets are a great deal less expensive now than they were a relatively few months ago.

—More and more tape recorders are being sold. Five years back, they were too costly for most people. Ten years ago, they weren't to be had at any price.

—New phonographs sound better than models just a few years old. There are many reasons, but one important contribution is made by a new-style pickup.

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small, are destined to replace scores of the complicated inventions of the last 40 years, from vacuum tubes to the agitators in washing machines

—A recent innovation in automobiles is a headlight that dims automatically as another car approaches.

—Are you reading this magazine by fluorescent light? Its glowing tube was one of the first harbingers of the new science. The photoelectric cell that opens doors automatically was another.

The exciting fact is not only that these changes are occurring (they're insignificant compared to what's coming), but that they are caused by little bits and pieces of solid matter—tiny, brightly colored rings, wafers and blocks, many of them no larger than the letter "o" on this page.

Some of these devices are taking the place of complicated wire and metal electronic gadgets; others are performing jobs that are entirely new, even revolutionary.

These little objects, or *stereatrons*, are tipping the electronics industry upside down. New ways to use them are being discovered literally faster than they can be developed. Some of the solids give off power when light is applied. Others give off light when power is applied. Some vibrate with tremen-

dous speed, a characteristic with great promise. Some change alternating to direct current, or amplify an electronic signal, or delay a signal for an instant—or remember it indefinitely.

In the latest television sets, certain *stereatrons* are replacing old-style rectifiers and transformers, at a considerable saving in cost (in addition, of course, the cost of TV sets has been cut sharply because of improved production techniques). The coating on the TV screen is composed of thousands of tiny *stereatrons*, and other *stereatrons* are beginning to take over the functions of the small tubes in all sorts of electronic equipment. The magnetic surface of the tape recorder, which "remembers" sounds fed to it, also consists of many tiny solids. Other solid devices are being used to help translate the vibrations of a phonograph needle into enjoyable sound.

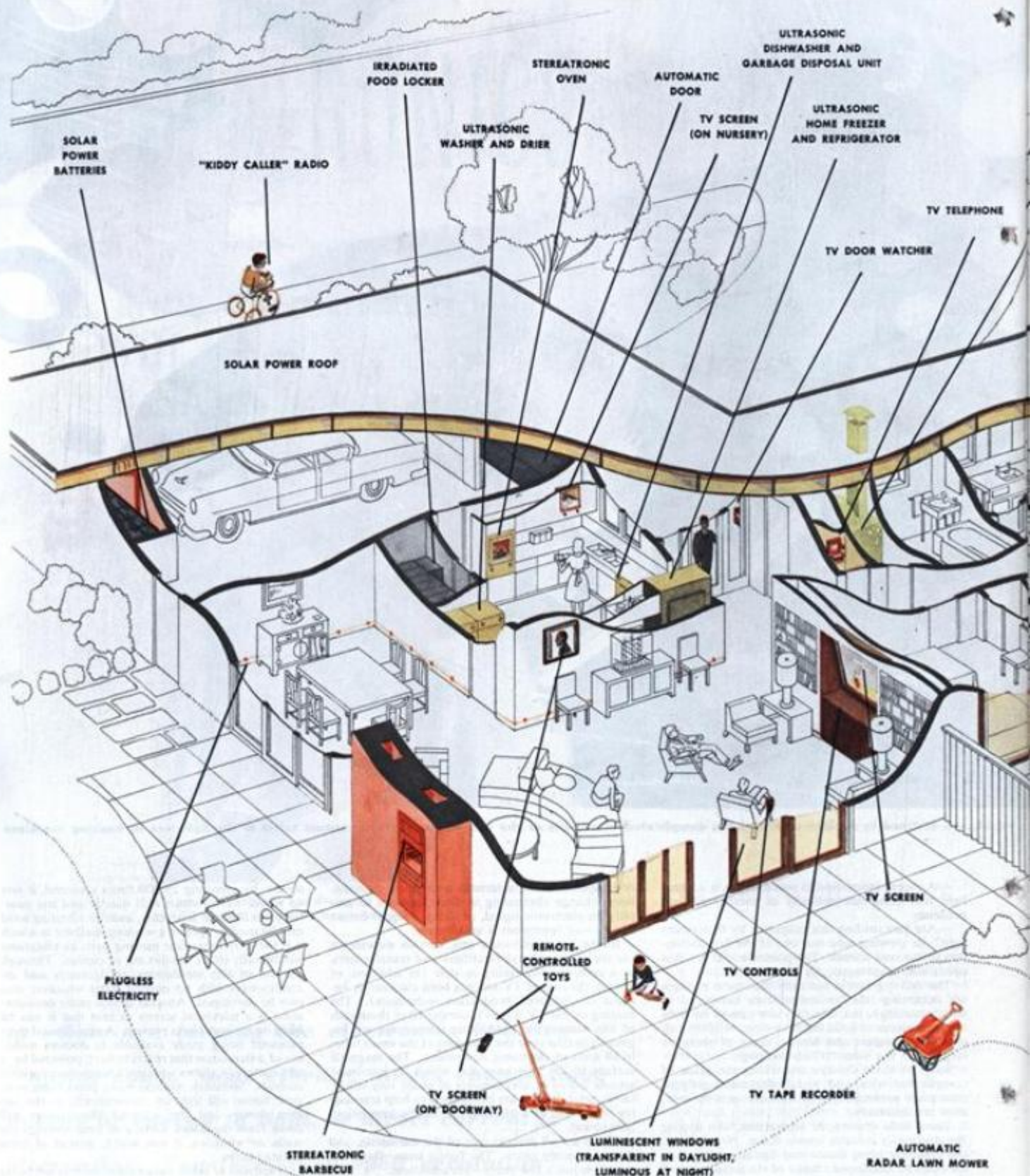
Those are all *present* uses of the *stereatron*, and there are many more. The future uses—those expected in just a few years—are countless.

A dentist's drill being developed consists principally of a piece of nickel, one of the vibrating *stere-*

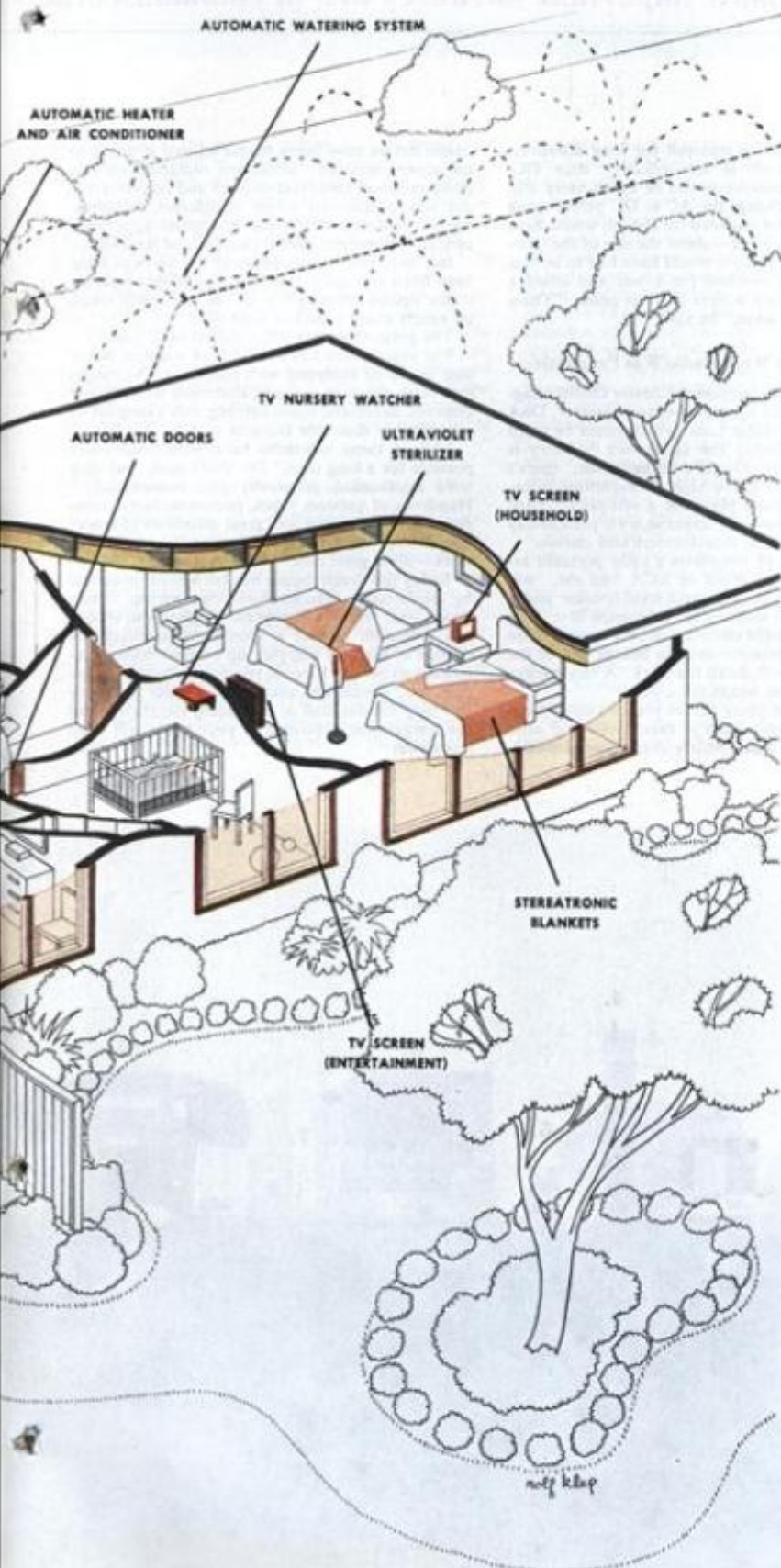
atrons; by vibrating 29,000 times a second, it sets up sound waves which drill quietly and less painfully. In the next few years, another vibrating solid may be used to operate a washing machine in which it is the only important moving part; its vibrations will literally shake the dirt out of clothes. Through the use of tiny *stereatrons*, refrigerators and air conditioners with no moving parts whatever also may be developed. Another device under consideration is a television screen so thin that it can be hung on the wall like a picture. A new clinical thermometer being made available to doctors makes use of a *stereatron* that reacts to heat; powered by a tiny battery, it shows a patient's temperature within seconds. Someday, not too many years from now, your house will light up automatically as the sun goes down—and the artificial illumination will come from the entire surface of your ceilings (or walls, or windows, if you wish), instead of from isolated bulbs.

Hundreds of other *stereatronic* devices are being planned which promise cheaper, more efficient, longer-lasting appliances, better communications,

Stereatrons have brought the electronic dream house close to reality. It will have



room-to-room TV and many wonderful appliances—inexpensive, efficient and automatic



improved transportation, new kinds of entertainment—even a general rise in the standard of living, through stereatronically operated factories. One of the most exciting projects envisions a tiny portable radar set which may provide the blind with a "picture" of the obstacles that lie in their path.

Progress in the field has been so fast that the scientists working in stereatronics—electronics engineers, physicists, chemists, metallurgists, ceramicists and mathematicians, among others—haven't even had time to compare notes. As a result, stereatronics hasn't developed a language of its own, as sciences usually do. In fact, until recently the science itself didn't have a name; physicists said they were working on "solid state physics," chemists referred to "materials research," and others used such names as "electronic solids," "solid state electronics," or simply "solid state."

How the New Science Acquired Its Name

While this report was being compiled, the word stereatronics (ster'e-a-tron'ics) was suggested by Collier's to fill a need felt by all of these scientists. It was derived, after consultation with both electronics experts and etymologists, from the Greek word for solids, *stereos*, and the word electronics. Defined as, "the science of the controllable electronic performance of solids," it is already in use among scientists in the field.

The lack of a name, according to some researchers, was a major handicap. It prevented co-operation among scientists working on various aspects of stereatronics, because they were unaware of the work being done by others. It added just one more complication to a science already beset by complexities.

"It takes nearly a full year of close teamwork on these solid devices," Dr. Lloyd T. DeVore, chief of General Electric's electronics laboratory, told me, "before our scientists and engineers can even begin to understand one another."

Stereatronics is a difficult science largely because it deals with the electrical and mechanical properties of matter—properties which defied comprehension for years and which even now experts find astonishing. In its 40 years of existence, the electronics industry has produced a variety of complex tubes, coils, transformers and so on, which have made possible the marvel of modern radios, television sets, lighting and the like. Now scientists are finding that the stereatrons do many jobs just as well, and some a great deal better.

The ironical fact is that radio engineers stumbled on the first practical stereatron long before there was any such object as an electronic tube, but failed to realize its significance.

Do you remember the galena crystal in the "cat's whisker" radio of the 1920s? Nobody knew why it worked, but it did unscrewable radio waves as they came in on an antenna, and at the same time transmitted enough energy to vibrate the diaphragms in a pair of earphones, so the radio waves became audible sound. The galena crystal had major shortcomings as a radio receiver. It wouldn't amplify the sound it received, and it was exasperatingly inefficient at pulling the right signal out of the ether; you might spend hours poking at it before getting the station you wanted. It ultimately was abandoned in favor of the more effective vacuum tubes.

"For all the years since," said Dr. DeVore, "we've been inventing wonderful gadgets in glass, wire and metal to make all our electronic equipment work efficiently—while all the time, if we'd only known it, nature, with a little help from us, could have done the same jobs at a fraction of the power and cost."

Today nature is getting a second chance. One of the most important results will be the miniaturization of all sorts of electronic apparatus, from bulky computers to portable radios.

Some of the computers now in use are so big they occupy whole buildings. The same machines, using stereatrons, will be packed into a space not much larger than a couple of filing cabinets. Furthermore, they'll be more efficient, more economical and longer-lasting than any computer which can be made today.

Other examples are even more striking. "Most modern electric-powered locomotives," Dr. Paul Jordan of GE told me, "operate on alternating current because direct cur-

Stereatronic house of future may derive energy from sun, particularly if remote from conventional power. Plugless electricity will do away with wall outlets; appliance works when stereatron-tipped wire is set against wall containing electric circuit. Stereatronic barbecue will use radar. Watering system uses humidity-controlled stereatron; when lawn is dry, device starts water for as long as needed. TV screens show regular programs or adjacent rooms, as desired



Dr. L. Devore, GE, compares radio of today and (right) all-stereatronic set of the future. Disks are speakers



Swedish firm has developed a phone which, through use of transistors, is operated by push-button control

Many of the most important advances are in communications

rent is impractical to transmit for long distances. Alternating current is less effective than DC, though; the locomotive would be much more efficient if it could change the AC to DC before using it. But the rectifier required for the job would have to be ridiculously large—about the size of the locomotive itself. At least, it would have had to be that large once." He reached for a box and sifted a dozen silver-colored wafers into his hand. "These will do the trick soon," he said.

Dick Tracy's Wrist Radio Was Prophetic

Some years ago, cartoonist Chester Gould imaginatively presented his comic-strip character, Dick Tracy, with a portable radio which could be worn on the wrist. Today the electronics industry is catching up with Gould's imagination; there's scarcely a concern in the highly competitive industry that doesn't have plans for a vest-pocket-sized radio receiver that will dispense with present-day tubes, wires, sockets, transformers and chassis.

"The innards of tomorrow's little portable receiver," Dr. Irving Wolff of RCA told me, "will be nothing more than a small loud-speaker and a plastic plate with some lines and bumps in it. The lines will be a printed electrical circuit—metal strips etched into the plastic—and the bumps will be the little solids that will do all the work. A tiny battery will run the whole works for a year."

It will be some years before you can buy one of the little portables. They're expensive—and military needs come first. Nearly every type of stereatronic device now being manufactured is going to the armed services. Solids are replacing various components in radio transmitters and receivers, radar sets, anti-aircraft target calculators, weapons-control systems, submarine acoustical apparatus, aircraft computers, guided missiles and the like.

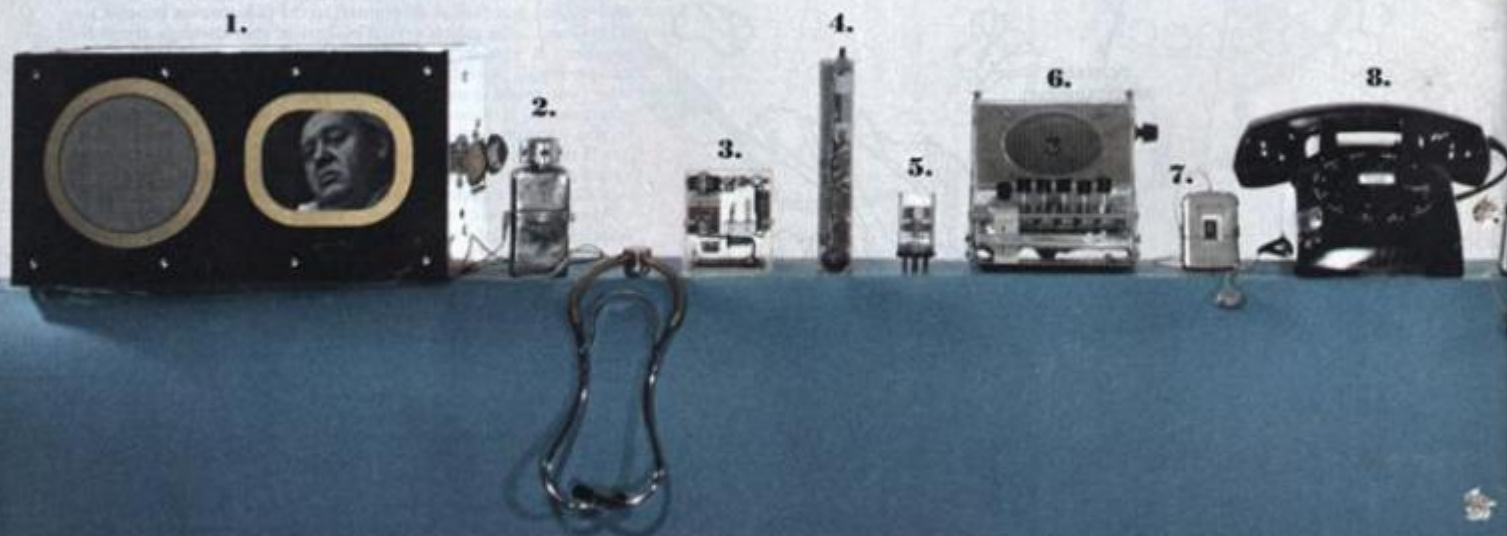
But once the requirements of the services have been filled you can expect a gradual flow of stereatronic equipment which, over the years, will touch on nearly every aspect of your life.

The greatest impact will occur in your home.

For years, there has been talk of a dream house that would be equipped with telephone-TV, ranges that cook meals in seconds, electronic temperature controls, automatic room lighting, and a long list of other highly desirable features.

"All of those advances have been technically possible for a long time," Dr. Wolff said, "but they were impractical, physically and economically." Hundreds of vacuum tubes, numerous metal components, miles of wire and great quantities of power would have been needed to make the equipment work—all at great cost.

Today the dream house has been made practical by stereatrons. Stereatron-studded wiring, strung inside your walls, will provide plugless and shockless induction power; a stereatron touching the outside of the wall will pick up current without requiring an outlet. Electric power will be less expensive, too: stereatrons used by the power company will help cut the cost of producing electricity, and the stereatronic appliance in your home will need less power.



—from tiny wrist radios to small, improved hearing aids

Some of the most important changes impending will be caused by the phosphor particle, a stereatron that gives off light when power is applied to it. A coating of phosphors is what makes the inside of a fluorescent light tube glow; and the same kind of coating, made bright in some places, dark in others, causes the picture to appear on your television screen.

A wall or ceiling panel coated with phosphors would become a source of light if an electric current were passed through it. Hook up a series of such panels to another of the stereatrons, one that reacts to the slightest change in outside light—and you have a setup that will turn on your house lights automatically as twilight falls, and keep increasing the intensity of the artificial light as the outside darkness increases.

Prospects for Picture-on-the-Wall TV

A new method of carrying electronic impulses to the phosphors on your TV screen will ultimately make possible picture-on-the-wall television. Instead of the bulky picture tube which now comprises nearly half your TV set, you'll have a flat screen that will be connected to your receiver by a few wires, and can be hung anywhere. The reason for today's long tube is the need for a so-called electron gun at the small end; it bombards the phosphor-coated screen with impulses that cause the tiny stereatrons to glow. The new screens will have a network of hair-thin wires which intersect behind each phosphor dot; as a signal hits the point where

the wires cross, the phosphor speck will light up to any degree of brightness that's ordered. The pictures can be in full color, of course.

Stereatronic advances will bring down the cost of television sets so that it will be practical to have a number of receivers and screens in your house. They will provide not only entertainment, but closed-circuit communication within the home, when used in conjunction with small, portable TV cameras (RCA calls them TV Eyes). The new cameras, about half the size of a telephone directory and weighing only a few pounds, will let you keep an eye on Junior in the playroom at the flick of a switch, or check to see who's calling when the front doorbell rings. The effectiveness of these midget cameras lies in a stereatronic coating on the face of a tube known as the Vidicon. This substance, a compound of antimony and sulphur, is sensitive to light. It also has certain properties which enable it to transmit as a TV signal the light variations (or pictures) it picks up—skipping a whole series of complicated amplifying operations required by large studio cameras.

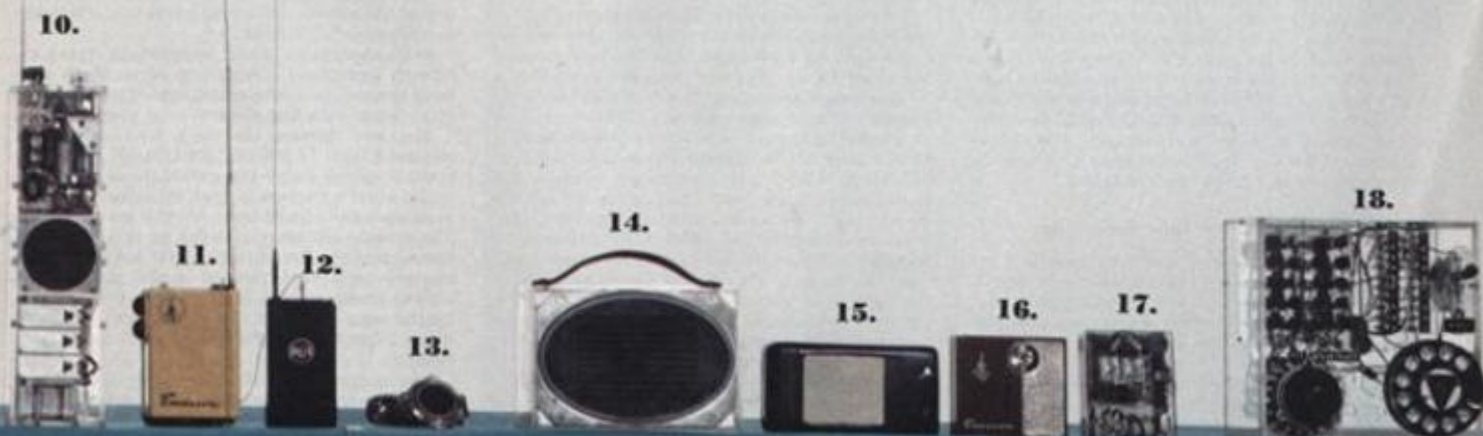
The RCA Vidicon tube (other companies have cameras of their own, some employing the Vidicon) costs about \$100 at present. The tube which does the same job in a studio camera is considerably more sensitive—but it's also 15 times as expensive, partly because it's so hard to manufacture that every second tube made has to be discarded because of imperfections. Of course, the Vidicon tube is only part of the camera; the complete Vidicon camera costs about \$900, far too much for general



A new stereatronic tape can record both sound and picture for video. Screen above shows how image looks

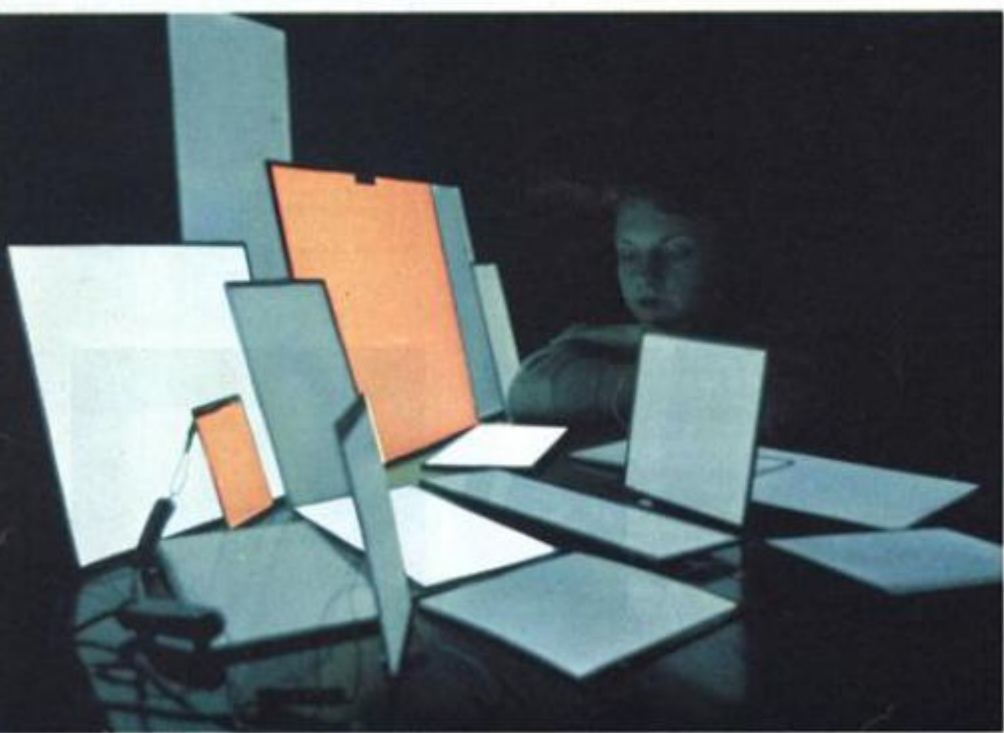


One TV color screen uses phosphor lines—shown magnified—"trained" to reproduce given color on demand



With stereatrons, many devices will be smaller, many completely new. Photo shows sampling of both types. 1. Portable TV set (RCA) runs on batteries, uses no tube but picture tube. 2. Electronic stethoscope (by Maico). 3. An FM amplifier-transmitter; 4. Portable wireless microphone; 5. High-fidelity amplifier; 6. Transistorized intercom set (all RCA); 7. Hearing aid (Zenith); 8. Phone (Bell) has volume control for deaf users; 9. Hearing aid (Maico); 10. A portable field receiver (Sylvania); 11. A walkie-talkie (Emerson); 12. A walkie-talkie (RCA); 13. Wrist radio receiver (Sylvania); 14. Portable radio has 6-inch speaker—because other components are miniaturized (RCA); 15, 16 and 17. Pocket portable radios (RCA, Emerson and GE); 18. Desk-size stereatronic computer (Sylvania)

One stereatronic experiment, though still at an early stage, holds dramatic promise:



Panels that light when current is applied to them may someday illuminate your house. Light is dim now (as shown by face of Sylvania worker Grace Daly) but future versions will be brighter

household use. However, the addition of other stereatronic devices is expected to lower the price substantially—perhaps down to \$150 or \$200.

And that will be a bargain indeed—because besides watching the baby, the Vidicon camera can be adapted to take home movies on magnetic tape. No processing will be required and you won't need a special projector. You'll simply play the video tape back through the recording apparatus and see on your TV screen, in full color and with sound, the pictures you shot a few minutes before.

New Fields for Tape Recordings

You'll also be able to use your recording apparatus to tape your favorite television shows. Moreover, you'll be able to buy video tape recordings of musical stage shows, just as you now purchase your phonograph records or 16-millimeter home movies.

Color video tape recording has already been developed experimentally, but for studio use only. The method is somewhat similar to standard sound-recording techniques on magnetic tape, but much more complicated.

The tape is covered with magnetic oxide particles. As it passes through the recorder, the tape picks up and stores away five signals, which comprise a sort of electronic shorthand. There's one signal each for the three primary colors, another for the sound track and a fifth which synchronizes sight and sound (the tape "remembers" the five signals because the electronic impressions rearrange the form of the magnetic coating). When the video tape is played back, this compact code, like a punched music roll on an old-time player piano, reproduces all the signals simultaneously as sound-and-color TV. Right now the process requires a complicated battery of equipment which fills one whole wall, but in time, RCA Chairman David Sarnoff says, "low-cost video tape equipment of simpler and more compact design than the

studio-type apparatus we now have can be made available."

Television also will be adapted, eventually, for use in conjunction with the telephone. But that advance will take a while, perhaps 20 years or more. Sending a TV picture from one room to another is a fairly simple procedure. Sending it to the house down the block is somewhat more difficult, because no simple equipment now known will transmit a picture over any substantial distance without amplification. City-to-city transmissions require the use of coaxial cables; the latest cables are capable of carrying 3,600 voice signals (that is, 1,800 conversations)—but of the cable's 3,600 channels, no less than 1,200 are needed to carry a television picture! To be sure, TV pictures can be transmitted through the air without the use of wires, but there simply aren't enough frequencies in the spectrum to carry the number of pictures that would result from widespread use of TV-phones.

It's a difficult problem, but not insoluble. As more and cheaper circuits come into existence and new transmission methods are developed, the videophone will become available. You'll just have to wait a little longer than for some of the other stereatronic advances.

But you won't have much of a wait for another telephonic development. By making use of the transistor (the most famous of the stereatronics, consisting of a tiny solid within a plastic or metal case), Bell Telephone engineers have already made direct long-distance dialing available in some communities, and they hope to have 20 exchanges converted to it by the end of this year.

The transistor will improve telephonic communication in other respects, too. Jack A. Morton, in charge of transistor development at Bell Laboratories, explained how.

"In a modern telephone switching office, to handle 10,000 subscribers at top speed we need 40,000 to 50,000 relays or switching units," Morton told me. "We'd like to replace these metal units

with vacuum tubes, which work 1,000 times as fast. But the average tube has a life expectancy of only a few thousand hours; with 40,000 tubes, we could expect one to fail every six minutes. And think of the heat the tubes would generate; obviously, tubes would be impractical.

"Transistors may solve the problem. They'll do the same job as vacuum tubes, using only a fraction of the power. Unlike tubes, they need no warmup. And above all, they're rugged: you can drop them or shoot them out of a gun—there's nothing to break. Properly made, they should last years."

Transistors for Smaller Hearing Aids

Some transistors are already on the market, but they cost from \$3.75 to \$50. Ultimately they should be available for less than a dollar. Meanwhile, they are being built into at least one consumer product. Zenith, Sonotone and Maico have used the little solids to replace tubes in hearing aids; as a result, the appliances have been reduced to about the size of a cigarette lighter—small enough to be hidden in a woman's hair.

Within the next few years, more and more transistors will be channeled into civilian production. That doesn't mean you'll be able to yank the tubes out of your radio and substitute the little stereatronics. New circuits will be needed; you'll have to buy another radio. But—eventually, at least—transistorized radios and TV sets will be cheaper than present sets, and much longer-lasting.

Industry is already gearing up for the transistor bonanza. A number of electronic manufacturers—including such major firms as Raytheon, RCA, GE, Philco, Westinghouse, Sylvania and Western Electric—are producing transistors. Others, like Zenith, Capehart, Admiral, Arvin, Emerson, Crosley, Hallicrafter and Stromberg-Carlson, have teams of researchers at work developing experimental transistorized equipment.

"It's like an Oklahoma land rush," said Professor Frederick Seitz of the University of Illinois, one of the pioneer solid-state physicists. "Nobody can afford to lag behind."

Bell Laboratories, which invented the transistor, recently announced another new device that's even more spectacular (although of limited usefulness so far): the world's first efficient solar power system.

The sun showers the earth with more than one quadrillion (1,000,000,000,000,000) kilowatt-hours of energy daily—comparable to all the energy in the world's reserves of coal, oil, natural gas and uranium—and almost every bit of it goes to waste. The greatest efficiency achieved up to now in converting sunlight directly into power has been about one per cent—for example, in the photoelectric cells in photographers' light meters. Bell's experimental solar power set (which, incidentally, is not much larger than a light meter) is six times more efficient.

The pocket-sized Bell solar energy converter is simply made. It consists of 10 razor-blade-thin wafers of specially treated silicon, each 2 1/4 inches long and half an inch wide. These sensitive strips are linked together with thin wires which run to two terminals. From the terminals the converter is connected to the power-consuming appliance.

When the sun's rays hit the sensitive silicon, sufficient power is produced to run low-current equipment; in demonstration, the device ran a cigarette-pack-sized transistorized radio and a toy Ferris wheel. Although Bell scientists estimate that in its present experimental stage it would take about 25 square feet of silicon wafer to keep a 100-watt lamp burning, the efficiency of the device is expected to increase considerably. Even now, telephone engineers are considering using units to run low-power mobile equipment or as battery chargers for amplifiers in rural telephone systems.

To power a small home from the sun's rays right now you'd need a silicon-surfaced roof covering a quarter acre or more—plus a battery so big it

new "eyes" for the blind

would fill two rooms, to store power for use at night. But scientists believe the solar-powered home may become practical someday, at least in parts of the world where conventional electrical power is now nonexistent or extremely expensive.

Although it's doubtful that solar power will be cheap enough in our lifetime to power great factories, other stereatronic advances may revolutionize the operation of industry. Chief among these are the projected computers—small in size, efficient beyond anything now known, and cool in operation. Even the relatively clumsy computers of today are taking over many industrial chores, particularly in accounting, inventory-taking, and certain self-service operations. The streamlined "electronic brains" of the near future may take over the whole factory.

"Suppose," said Dr. Samuel B. Batdorf of Westinghouse, "that a factory requires 100 machines to manufacture its product, all doing different jobs and running at differing speeds. Today, 100 operators are needed to watch the dials and regulate the speeds. In principle, one computing machine could do the job better, 'reading' one dial in a few millionths of a second, and instantly sending instructions to motors controlling the speeds. Then the same computer could turn its attention to the next machine, and so on. It would take about one second to control all 100 machines. One reason it hasn't been tried so far is the limitations of the vacuum tubes. But solid devices make it possible."

Devices That Will Benefit the Blind

The new science of the solids seems certain to change the world in highly dramatic fashion. But what may be the most dramatic change of all will affect only a tiny minority of the world's population: the blind.

At the Massachusetts Institute of Technology a team of scientists under the direction of Dr. Clifford M. Witcher—himself blind—is developing an electronic-stereatronic bag of tricks which eventually may make it possible for a blind man to "see" where he's going through a series of impulses communicated to his hand. The scientists have most of the facts they need right now, but—as MIT's Professor J. Earl Thomas puts it—"the blind man would need a trailerful of tubes, radar equipment and other components." Stereatronics, by sharply reducing the size of the equipment required, will go a long way toward solving that problem.

At present Dr. Witcher is working on a preliminary device which indicates to a blind person the whereabouts of stairs, curbs and similar "step-down" obstacles. The blind man holds a boxlike apparatus with a light which scans his path; when it strikes something, the reflection causes the handle of the box to vibrate. "At the moment," said Professor J. B. Wiesner, director of MIT's electronics research laboratories, "the device is only experimental and years of development are needed before it can be made practical . . ."

"But eventually," Professor Thomas told me, "by using all types of stereatronic devices, we'll be able to produce a radar-type instrument which will paint a map in Braille for a blind person. My guess is that this apparatus will be about the size of a woman's handbag. The blind person will place one hand on the outside of the bag and feel the whereabouts of everything in front of him."

No one is more impressed by the tremendous new avenues of progress opened up by the stereatronics than are the scientists themselves. "You might sum up the significance of the new science this way," said Dr. Henry O'Bryan, manager of Sylvania Electric's physics department. "First came electricity, then electronics. Now we're beyond electronics into something just as far-reaching."

Or, as RCA's General Sarnoff put it: "Science and electronics are moving so fast that in ten years everything we're now seeing will be so obsolete that we won't recognize them . . ."

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Dr. Clifford Witcher, blind scientist of MIT, demonstrates his experimental device to assist sightless in locating obstacles. Light causes photoelectric cell to set up vibrations in box handle



by Lawrence Lessing

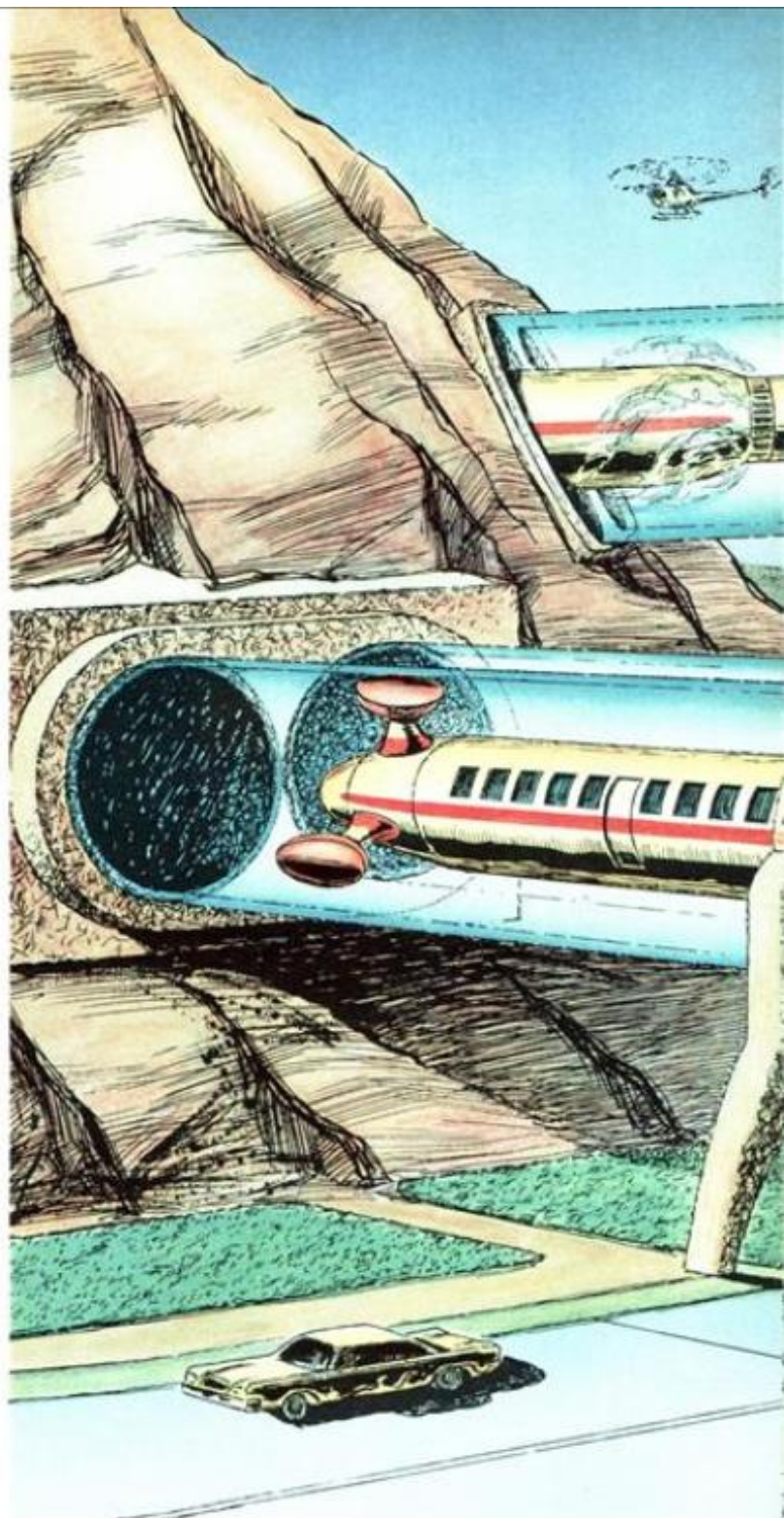
before Baltimore he picks up a phone and completes his arrangements in Washington. The trip, door to door, takes something under two hours.

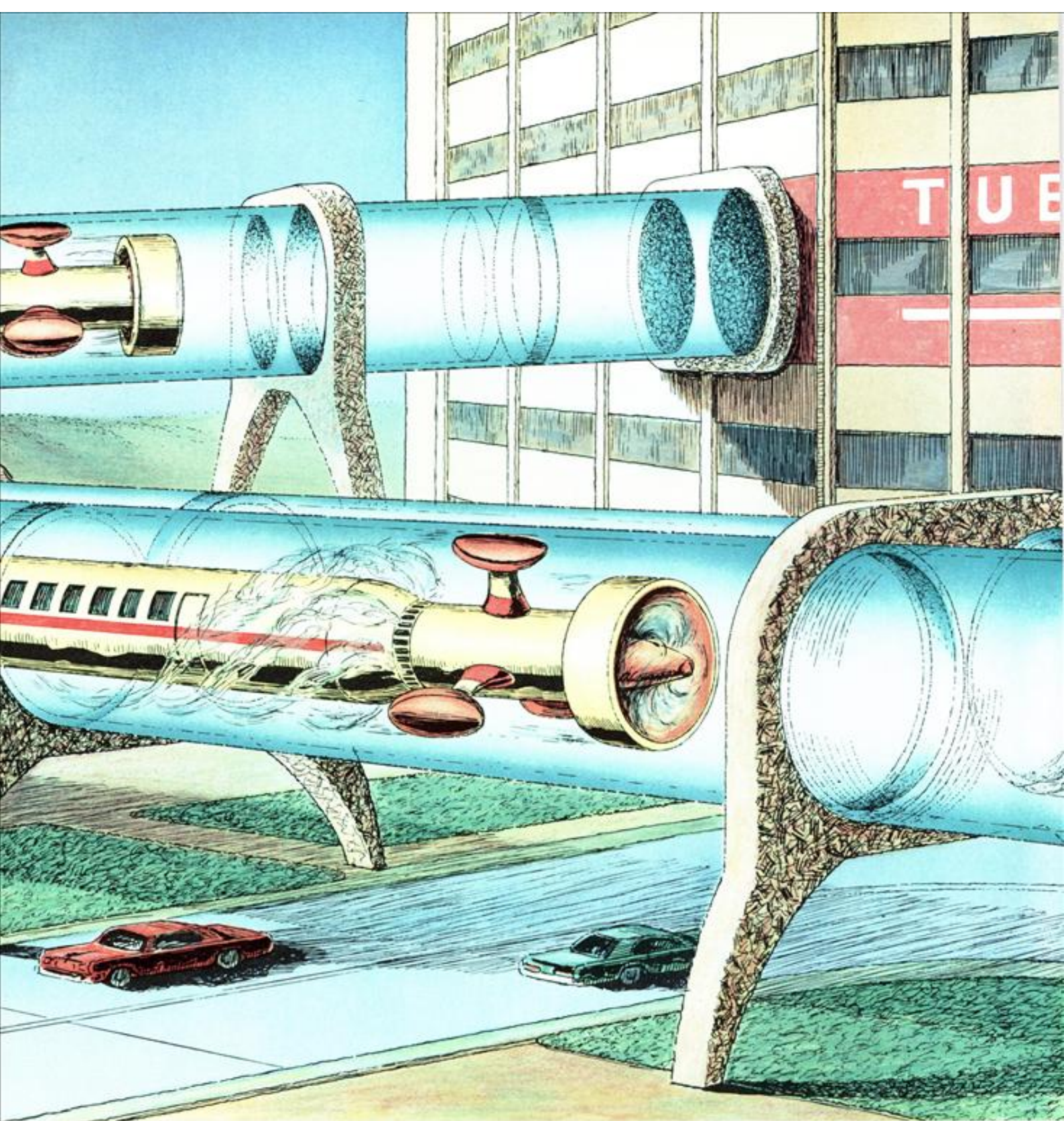
This vision may appear to be the purest moonshine to the much-jolted and discouraged riders of today's railroads. Yet all of it is well within the abundant technological resources of the day. And the tubular train is only one of half a dozen devices being seriously considered by the Northeast Corridor Project, a federal program designed to demonstrate what can be done to rejuvenate mass ground transportation in the densest traffic area in the U.S. The project was initiated in 1962 by the late President Kennedy. After a task-force study, he directed then Secretary of Commerce Luther H. Hodges to undertake a thoroughgoing exploration of what government might do to improve and coordinate all transportation in the critical corridor. Before his retirement early this year, Secretary Hodges set a goal of 200-mile-per-hour rail travel between Boston and Washington to cut travel time from something over eight hours to something under four. The project is now completing its preliminary planning phase and is ready to take off on its first active research stage, with a boost from President Johnson's State of the Union Message and a slated fiscal budget of \$20 million.

This program is not to be confused with the federal mass-transit program, administered by the Housing and Home Finance Agency, which has an initial budget of some \$400 million to aid cities in shoring up and improving present commuter services—an entirely different, short-range, and specialized problem. The Northeast Corridor Project looks beyond this to a longer-range, more basic technical solution to transit problems, and specifically to intercity travel. For it quickly discovered that a great gap exists in really basic research on advanced ground-transportation systems, due to over half a century of neglect by the industry as well as government.

Without delay, therefore, the project's director, Dr. Robert A. Nelson—a transportation expert brought in from the University of Washington in 1963—let a \$500,000 study contract to the Massachusetts Institute of Technology to make a broad survey of all the technological possibilities. The M.I.T. report is due this June. A major part of its job is to block out broad research projects and areas—such as propulsion, guidance, computer control, and network layout—in which the government might profitably invest research funds, looking toward the final construction of a new system. To keep an open mind about what that system may be, as well as to stay out of the rut of railroad thinking, M.I.T.'s engineers use the term "guideways" instead of rails, "vehicles" instead of trains, and they borrow freely from the concepts and proved techniques of aerospace system development.

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New Yorkers with business in Washington may someday make the trip in sixty minutes flat—through a tube. This system is one of the further-out schemes for mass transportation now being explored by the federal government's Northeast Corridor Project. It was conceived by Dr. Joseph V. Foa, head of Rensselaer Polytechnic Institute's department of aeronautical engineering and astronautics. The 130-foot vehicle pictured here would carry 104 passengers. Powered by turbofan jets and riding on six huge air-cushion pods, it would slip through the tube at near-frictionless speeds of 250 to 400 miles per hour. The tubes—transparent in this painting to reveal the vehicles—would actually be steel casings fifteen feet in diameter. Like huge pipelines, they would bore through rock, run underground, on the surface, or on elevated structures. Some engineers think that the tunnels would run more straight and stable 500 feet underground.

The 400-Mph Passenger Train

It may ride on air cushions rather than on rails, and be driven by jets or even rockets. A number of far-out ideas are competing for serious development. And industry is studying a big new market.

By 1980, unless something drastic is done about it, traffic in the populous northeast corridor of the U.S. between Boston and Washington will have reached an imbalance and impasse of monstrous proportions. Already, superhighways in key metropolitan areas are reaching congestive saturation, though close to \$2 billion has been spent on those in the corridor alone since 1945. And congestion in air-lane and airport facilities, on which over \$1 billion has been spent in the same period, is already severe. By 1980, preliminary studies show, the corridor's population will have jumped by some 25 percent to well over 50 million. At the same time travel between cities, in the increasing mobility of the era, will have more than doubled or tripled.

The indiscriminate proliferation of superhighways seems less and less of a solution. For one thing, rights-of-way are getting hard to come by and costs are steeply rising, not only in dollars but in land blight. Eventually, if highways spin out unchecked, the whole northeast corridor, following the pattern of Los Angeles, will be largely concrete. Perhaps the superhighway quandary is best illuminated by a proposal last year to double part of the already overburdened New Jersey Turnpike from six lanes to twelve, at a cost of some \$350 million. The Port of New York Authority, whose cooperation is required, blanched and promptly cried halt. For not only are the tunnels connecting the turnpike to New York incapable of carrying the added traffic, but no one would know where to put it once it got into Manhattan. Ultimately, if this madness continues, cities will have to hang out signs similar to those on their parking lots: "Full up."

While congestion on roads and airways was everywhere growing worse, the railroads, historically the most efficient mass movers of people and goods, have been suffering a precipitous drop in traffic. This is not the place to go into the well-known plight of the railroads, delicately balancing the blame between government misdeeds and private mismanagement. The signal fact is that today 91 percent of all intercity passenger travel, including commuter traffic, is by automobile. Of the remainder, the railroads get only 3 percent, where once they had nearly all.

The railroads struggled against this tide. In the last decade or so technical improvements plus tax easements have won back freight traffic and a measure of profitability.

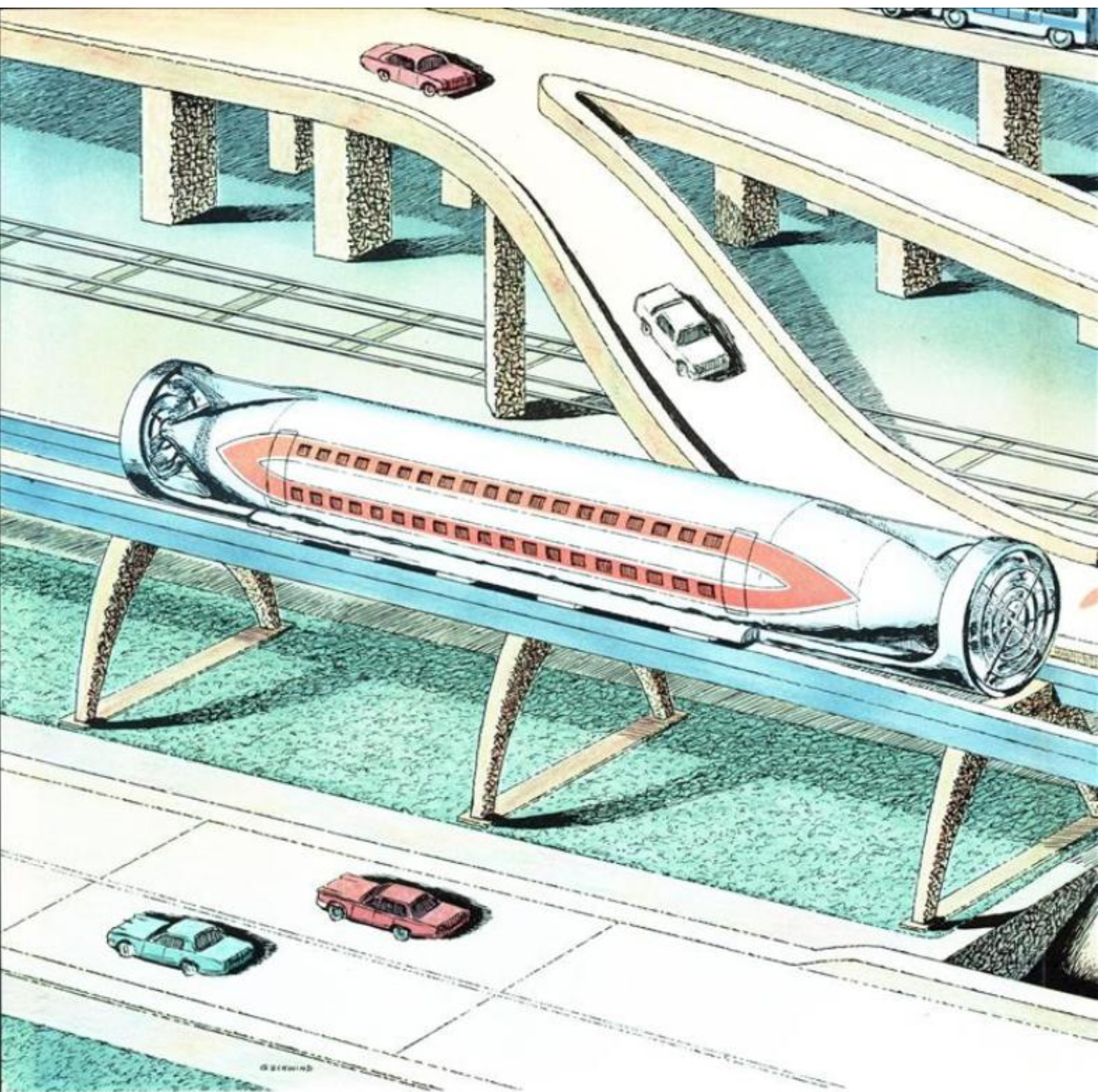
And since World War II all manner of new equipment has been tried, including lightweight cars, Talgo trains, and new sleeper services, to win back passengers. But all these measures represented only marginal improvements, thinly spread, upon a transportation system basically unchanged since the last century; no substantial increase in passenger-train speeds has been shown since 1900. Against the rising power of the automobile and aircraft, aided by massive federal subsidies for highways, airports, and aeronautical research, the railroads fell further and further behind in the *sine qua non* of twentieth-century travel—speed, comfort, and convenience. Their grimy, cavernous terminals took on the aura of a departed age.

As passenger volume melted, most railroads, primarily freight carriers to begin with, found passenger services becoming a fifth and flat wheel on operations and earnings. Under the burdens of an outmoded system, archaic labor practices, and encrusted rules and regulations, every passenger lured back only added to the enormous running deficits. By 1960 over 100,000 miles of track had been taken out of passenger use, and one route after another was being cut back or terminated. As the railroads abdicated their role as passenger carriers, the government was forced to put up ever mounting funds just to keep some vital but decrepit lines running. Over \$40 million has been pumped to date into the rickety New York, New Haven & Hartford Railroad, with no end in sight. Most railroad men, except for a few hardy Westerners, became convinced that passenger traffic was something to be shunned. Some even predict that most railroads will be entirely out of the passenger business by 1970.

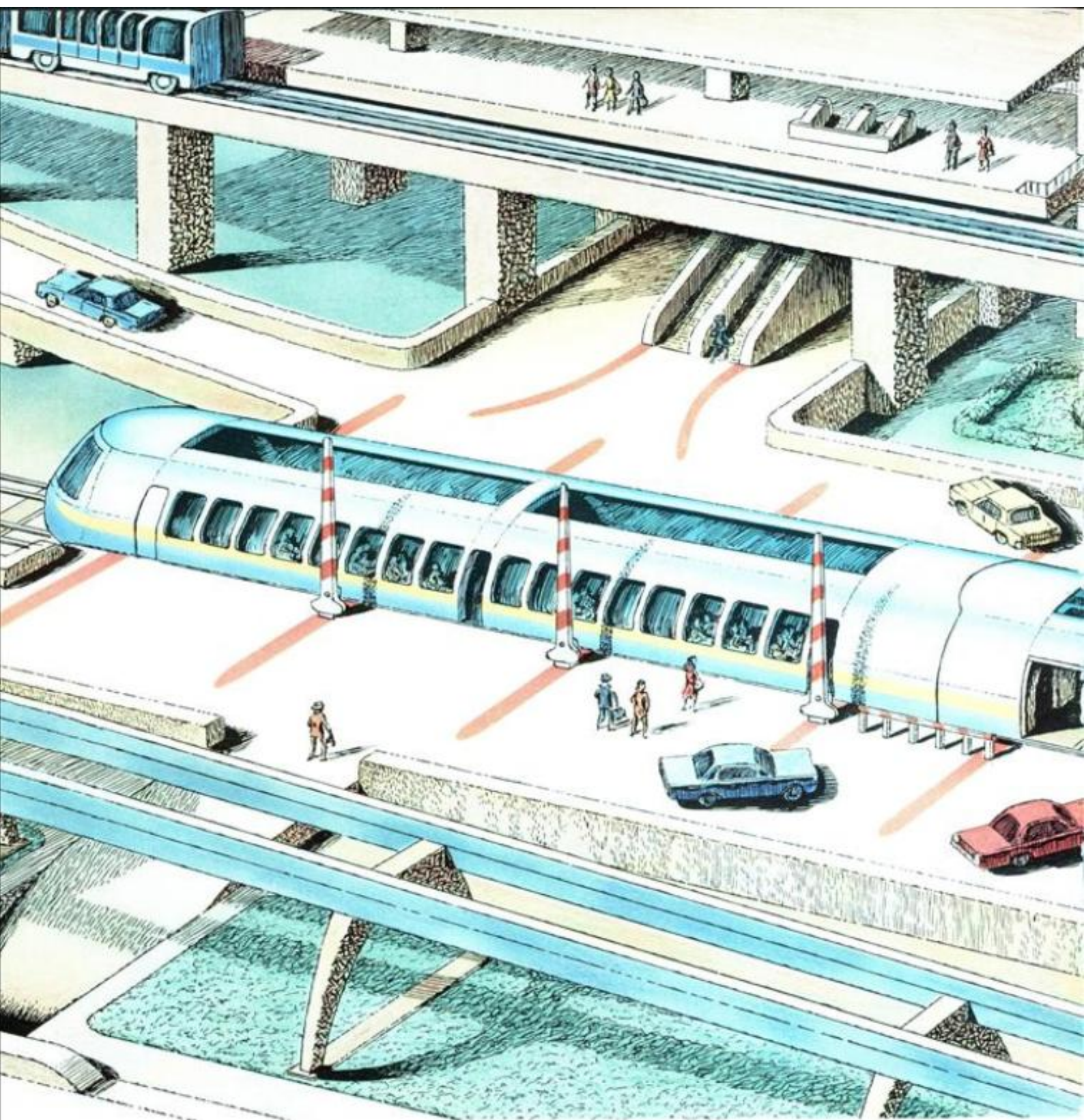
But precisely at this depressing juncture some startling developments are under way to reverse the outlook. After years of inaction, government is joining with research science, inventive engineering, and advanced industrial skills in pursuit of a new vision of superhigh-speed ground transportation.

A new transportation vocabulary

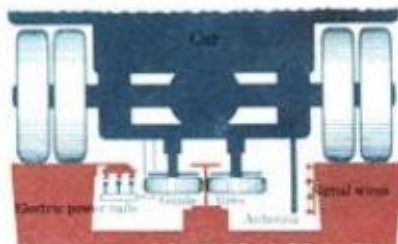
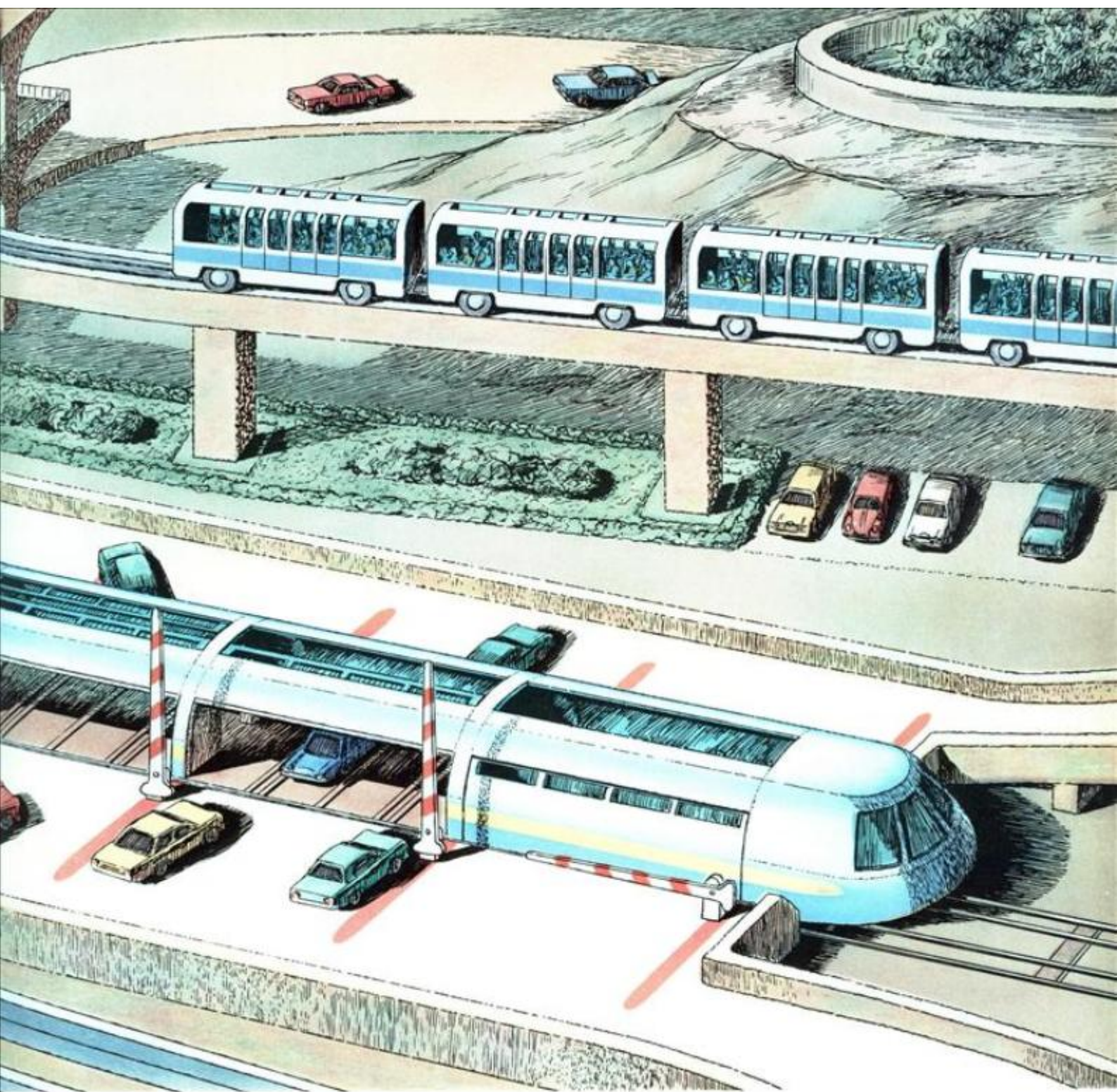
The passenger from Boston enters a train of long, slim cars shaped like projectiles. Soft music plays as he sinks into a contour chair, straps on a seat belt, and tells a pretty hostess his destination—Washington. With a slight, almost imperceptible lift, the train takes off down a gleaming metal tube, swiftly gaining speed until it reaches a steady, smooth, softly aspirating 400 miles per hour. At Providence, Hartford, New York, and other intermediate points, the train, without slackening speed, spins off cars and picks up new ones via high-speed feeder loops. Somewhere between Providence and Wilmington the passenger has a haircut in the lounge's barbershop, orders a snack and a drink, and watches an up-to-the-minute newscast. Just



Three trains of the future are shown in this entirely imaginary montage. Directly above is the Levacar, which slides on a thin cushion of air over an elevated system of smooth, square guide rails. It was worked up to the laboratory-model stage by the Ford Motor Co.'s research and engineering division. The principle (see diagram, left) was devised by Dr. Andrew A. Kucher, research director at Ford until his recent retirement. Instead of wheels, the Levacar has a series of perforated metal plates, called "levapads," through which a compressor pumps a thin film of air between the plates and the guide rail beneath, raising the plates a fraction of an inch off the rails. The vehicle glides, under a minimum of power, on the air film. A safety flange, attached to the levapad assembly, prevents derailment. The double-deck Levacar shown here would be powered by turboprops and carry 200 passengers at speeds of 150 to 350 miles per hour.



The big auto-ferrying train, center above, is General American Transportation Corp.'s answer to the mass-transportation problem. It was conceived by Deodat Clejan, the company's director of transportation planning. The idea is to lure intercity auto travelers off the highways by enabling them to take their automobiles along with them at speeds up to 200 miles per hour and at fares equal to toll-road mileage costs. The train would be made up of huge, 24-foot-wide, 128-foot-long cars operating on 18-foot-gauge tracks and a special roadbed. Propulsion would be conventional third-rail electric, but entirely automatically controlled so as to permit safe service at intervals as close as five minutes between trains. Passengers would drive their autos through automatic tollgates onto the train, relax in lounges provided at one end of each car, and have their own cars handy for use at the end of the journey. A few all-passenger cars would also be included.



The feeder line of small trains at the top of the page is Westinghouse's new, all-automatic Transit Expressway system, an advanced, short-range commuter system of a type that may eventually link into a long-range, high-speed, intercity system. The computer-controlled trains are composed of lightweight electric cars holding twenty-eight passengers each, riding on rubber tires at speeds of fifty miles per hour and at two-minute intervals on a special roadway. The cars are steered front and rear by means of pneumatic guide wheels running against an I-beam rail in the center of the roadway (diagram, left). Wires on the rim of the roadway would transmit all operating data and orders to and from automatic controllers at each station. A full-scale, \$5-million demonstration of the system will be made this summer on a two-mile loop track in Pittsburgh's South Park, jointly sponsored by federal, state, and local government, and local industry.